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As Government have been pleased to authorize Collectors and Paymasters at out-stations to receive into their Treasuries the Subscriptions due to the *Madras Journal of Literature and Science*, the Committee particularly request that the Subscriptions to this Number, and to all others, may accordingly be handed over to the nearest Collecter or Paymaster.

The Committee acknowledge the receipt of the following Subscriptions from out-stations.

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INTRODUCTORY NOTICE.

The Committee of the Madras Literary Society having resolved on commencing the re-publication of the " Madras Journal of Literature and Science," desire briefly to point out what have been the general scope and objects of this work.

The Journal had up to the cessation of its publication served as a repertory for all matters of local interest, whether literary or scientific, connected with the History, Geography, Antiquities, Literature, Ethnology, Natural History, and Meteorology of Southern India. A reference to the numbers of this Journal will show how considerable an amount of useful and valuable information has thus been collected and preserved.

Many observations must frequently occur to persons attached to Science, worthy of notice and interesting to the public, which are often withheld from an undue diffidence as to their being worthy of formal communication to the Literary Society.

Such Notices will be received with pleasure, and after submission to the Committee of Papers may find an appropriate record in the Society's Journal.

Narratives of Journeys undertaken with Scientific views or even visits to new or little known places will be received with interest and any observation as to the Local Fauna or Flora of particular Districts will be highly valued.

The want of some such means of imparting to the public valuable discoveries in all such subjects has been very generally felt; but a work of this description must depend mainly on public support and this it is not unreasonable to expect that the pen as well as the purse of the Community at large will furnish.

In inviting, therefore, Contributions as well as Subscriptions to the Journal on its re-publication the Committee trust that their appeal will be readily responded to.

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MADRAS JOURNAL

OF

LITERATURE AND SCIENCE.

NO. 1.—NEW SERIES.

October—December, 1856.

I. *Description and plan of the Natron Lake of Loonar, with an analysis of the Salt. By* George Smith, M. D., *Residency Surgeon, Hyderabad.*

[The following interesting description of the Loonar Lake of Berar was communicated by Dr. Smith to the Committee for the Madras Exhibition for 1857, and placed by them at the disposal of the Madras Literary Society, for insertion in their Journal.]

Description of the Lake of Loonar.

In the Circar of Meinker Soubah of Berar, about 45 miles N. W. of Hingolie in Lat. 20° N., lies the curious Natron Lake of Loonar. It is situated at the bottom of a crateriform depression, which forms a singular and unexpected interruption to the general gentle undulatory character of the district. The Lake is 510 feet below the level of the surrounding ground*—has a rounded outline and is about 3 miles in circumference. The sharp edge of the great excavation is about 5 miles round and the inner surface of the bowl rises abruptly at an angle of from 75° to 80°. The surface of this sharp slope is covered with luxuriant vegetation, in the shape of trees† and thick, vigorous underwood, tenanted by the tiger, hog, panther, deer and peacock. Between the sloping bottom of the

* As calculated in January last by the aneroid, which during the descent from the brim of the crater to the level of the lake rose 6-10ths of an inch, nearly 510 feet.

† For list—vide Appendix No. 4 extracted from Surgeon Bradley's Memoir.

abrupt dip and edge of the still green lake, the ground especially to the N. and N. E., is under cultivation, and the luxuriance of the crops shews the excellence of the soil and the abundance of the irrigation. Water is supplied freely from springs of sweet, soft water, close to the edge of the lake, and near the surface of the ground as well as from the streams, which in the rainy reason, come from the surrounding water shed, and which have left their vertical trace upon the walls of the crateriform hollow. Here and there, in the thick recesses of the wood, are observed small deserted and ruined Hindoo temples, built of the common compact Trap of the district. Many years ago, an officer, upon entering one of them, was seized and seriously injured by a tiger. The lake, a still sheet of water, emitting an intolerable stench of sulphuretted hydrogen (especially during the heat of the day, when the gas rises in millions of bubbles to the surface of the water), has a bright green color owing to the abundance of confervæ on portions of its surface, especially near the edges. The mud close to the margin of the lake, is thick, black, salt and tenacious, from the mixture of regur, salt and alum—when dry, fan shaped, black, glassy crystals of carbonate of soda are seen. The lake has evidently lately extended its bounds a good deal, as proved by this, that numerous dead trees are standing within its margin (for every tree touched by the lake dies) and also by the fact, that a bowrie of sweet water, protected by a low wall is now completely surrounded by the water of the lake. Reptiles, fish, and insects are never found in the lake, but flocks of teal and duck dot its surface. The water has a salt and nauseous taste, and its emanations are said to give rise to fevers of intermittent and remittent types.

At two points, near the centre of the lake, distant from each other about ½ a mile (judging by sight) are two saline springs which have never been known even in seasons of extreme drought, to become dry. It is supposed that the muriate of soda from this source, coming in contact with the carbonate of lime found abundantly in the other springs of the lake, and in the surrounding rocks whence it is washed down by the feeders of the lake, causes the deposition of the carbonate of soda or natron salt, in a state of greater or less purity. The purest varieties, containing upwards

of 50 per cent of the neutral carbonate, being found close to the saline springs themselves—whence it is raised by diving. The depth of the lake near the springs, varies from 5 or 6 feet in the hot months, to 12 or 14 during the rains.

Description of Salt.

There are six principal varieties of salt to which the natives give the following names:—1 dulla, 2 nimuck dulla, 3 khuppul, 4 puppree, 5 bhooskee and 6 madkhar. Dulla and nimuck dulla are used for dyeing silks, fixing colors, and as medicine, and in the manufacture of bangles.* Of khuppul, there are two kinds, one of greater value than the other; this salt is used in fixing the red dyes of cloths. Puppree is used in the manufacture of bangles, in the baking of a cake called papur—and by the native hukeems as an anti-acid in dyspepsia. There is also an inferior description of puppree. Bhooskee is a white saline salt, left as a deposit on the margin of the lake, and is principally used in the manufacture of soap. Madkhar is an inferior kind of bhooskee, used by Dhobies in bleaching clothes. The purest salt is found close to the saline springs, and the other salts in their order, as entered above, are found on receding from that point towards the margin of the lake.

Salt how raised, transported and sold.

The salt is raised by divers who proceed towards the centre of the lake, in canoes (recently introduced by Major Johnston†) formed of single pieces of light wood, from 14 to 16 feet long and $2\frac{1}{2}$ broad. The divers remain under water several seconds, and come up with their hands full of salt. When the lake was very shallow in 1836, the salt was scooped up by the iron pans or towas, on which natives bake their bread—no dredging instruments are used. The process of raising the salt is rude, tedious and insufficient. The salt thus raised is much prized, and finds a ready sale in both Berars, in Nagpore, Candeish and Poonah. It is purchased at the

* There are two manufactories near the lake. When these are in full operation, bangles are manufactured in large quantities, each man being able to manufacture from 6 to 700 daily. The eye-sight of these men fails soon, owing to the entire want of protection from the glare of the glass furnaces. Crystallized Quartz is abundant.

† For much of my information, I am indebted to the kindness of Major Johnston, Deputy Commissioner of Southern Berar.

lake by dealers, who carry it to considerable distances in bamboo baskets, and retail it.

History of the Loonar Salt Trade.

The lake has not been worked regularly since 1836, twenty years ago. A detailed statement* of the results then obtained, is appended for the information of the General Committee. From this carefully prepared table, it will be seen, that 2,136 candies of the several kinds of salt were raised, each candy being equal to 240 seers. The aggregate value of the whole being Rups. 60,081, of which sum, the Government (Native) share amounted nominally to 45,000. Since then, Major Johnston informs me, the lake has not been worked, and the salts are consequently in great demand, so much so, that inferior substitutes for the salts, supposed to be obtained from vegetable products† are procured from Bombay and sold in both Berars. Last year (1855) Major Johnston, as an experiment,‡ raised from the lake 35 candies of the several descriptions of salt, the value of which amounted to Hyderabad Rupees 1,461-4, the expense of raising, &c. to Rupees 522-9-9 leaving a profit to Government of Rupees 938-10-3 equal to about Rupees 26 per candy.

Suggestions under consideration for enhancing the revenue of the Lake.

The suggestions which have been proposed for increasing the productiveness and revenue of the lake, and which are at present under consideration may be stated briefly to consist of—

1.—Contrivances for preventing the flushing of the lake with water, supplied by the main-feeder, and by the several streams from the surrounding water shed—such as bunds and channels.

2.—Means for raising the salt with facility, and in due quantity—such as dredging machines.

3.—Means for procuring the salts in greater purity—such as evaporating pans.

4.—Means for protecting and preserving the salt raised—such as sheds, store-rooms, &c., with careful supervision by trustworthy Government officials.

* Vide Appendix No 1.
† Impure carbonates of potass from burnt wood probably.
‡ Vide Appendix No. 2.

Remarks on the Geology of the Loonar Lake.

In an able statistical memoir of the Circar of Meikher, drawn up by Surgeon Bradley of the Contingent, then on special duty, the opinion is re-advanced and supported by Geological facts, that this singular and wild looking excavation, is the crater of an extinct volcano. On this point, however, there exists amongst Geologists, I believe, some difference of opinion, so that the question may be regarded as still "sub judice." A jagged and picturesque rent exists in the N. E. wall of the supposed crater, down which runs the little stream which passes through a stone channel called the cow's mouth, forming part of a Hindoo temple, which is perched romantically upon a spot near the top of the ravine. Since the destruction of a weir too, during the rains, a large and deep nullah is filled with water which rushes down the ravine. The water as it passes over the almost vertical face of a Trap wall deposits travertin in considerable quantity. Through this great rent, the lava current is supposed by Surgeon Bradley to have found an exit, whence he supposed it to have spread over the surrounding country. Whilst descending the ravine, the rough natural section thus exposed, shows Trap rocks of various kinds, vesicular, compact and amygdaloidal. Masses also of ferruginous trap, weathering red, are seen with seams of chalk, reddish ochre, clay and disintegrated trap having all more or less of a stratiform aspect. During the Resident's recent tour to Hingolee, Loonar, Mominadad, Oodygheer and Beder back to Hyderabad, the whole route with the exception of the syenite and green stone near Hyderabad, and the laterite plateau of Beder lay over an uninteresting country of Trap to the entire exclusion of rock of greater Geological and Paleontological character. In many places, the Trap bears features precisely similar to those observed in the walls and rent of the Natron Lake; at times, the Trap was in solid blocks with vertical seams and irregular horizontal rents—often seen in bowries—again, it was amygdaloidal the nodules being imbedded in concentric laminæ of disintegrated trap and argillaceous shale, the beds being laid over chalk, argillaceous schists, marls, red ochre and green earth—again, it appeared in rude, but distinct strata, almost as regular as the layers of stones in a wall—again, it appeared disor-

ganized with seams, thick or thin, of chlorite, calcspar, quartz and calcedony, in contact with marl—again, it was seen in vertical shells containing triangular fragments easily separable—again, as vesicular,trap cavities being some times distant and empty,at others close and filled with adventitious minerals—again, it was solid, compact, and of a leaden black hue—again, it was reddish and ferruginous, —again,where it underlies the laterite, it was co-mingled with that deposit, and where it slopes over the syenite, boulders of that rock were imbedded in its mass—these the Committee should be informed, are merely the personal remarks of an inexperienced Geologist. The same appearances with a few exceptions were observed at Loonar and in its neighbourhood. It appears to me, as if the rocks constituting the supposed crater were too compact, to have issued from a sub-aërial volcano, though it is more than probable that this was one of the vents of the great eruption of the Trap of the Deccan, which was at first effused, it is supposed, under the pressure of water.

The points, to which the attention of the General Committee is respectfully solicited in this reference, are the following :—

a.—What is the exact chemical composition of the several salts?

b.—What is their commercial value, as now sent?

c.—Are the suggestions alluded to as under consideration, correct in their general principles? and

d.—Can the salts at Loonar be profitably separated from each other, and if so, by what process or processes?

.—The following specimens are forwarded for examination—

1.—Dulla.

2.—Nimuck Dulla.

3.—Khuppul.

4.—Puppree.

5.—Madkhar.

6.—Bhooskee.

7.—Travertin.

8.—Quartz used in glass-making.

9.—Glass prepared for the manufacture of bangles.

10.—3 Bottles of water.

[Further communication from Dr. SMITH, accompanied by a plan and section of the Lake.]

In the plan now submitted, the crateriform shape of the hollow is well seen, and if the opinion of some Geologists be correct, namely, that this hollow is the crater of an extinct volcano, the interest felt in it must be deepened by the fact, that, in all probability it is the only one in southern India.

The action, however, even of a large crater like this must have been comparatively limited, other vents and fissures, which have left no permanent mark of their existence must have given exit to those vast sheeted masses of porous and solid rocks constituting the trappean plateau of the Deccan. This plateau over lying primary and secondary rocks to depths varying from a few feet to 300 probably, covered with a rich mantle of inexhaustible black soil, and capped here and there along its eastern indented edge with laterite patches, extends from 17° to 27° N. L. and from 72° 30' to 79° E. L.

It may be interesting to remark, that at the South East angle of the plateau, the existence of numerous hot springs seems to indicate the persistence of igneous action. Taking Loonar as a centre, and with a radius of 150 or 200 miles, the quarter circle extending from the North East to the South East, will be found to include (a) the tepid spring of Beder, rising from the base of a laterite cliff; (b) the hot springs at Kair on the Pain Gunga (87° Bradley) and (c) the hot springs near Labbundee (102° Bradley) lying in a North Easterly direction.

APPENDIX No. 1.

STATEMENT *of Salt Extracted from Loonar Lake from*

		Dulla per Candy 57 Rupees.						Nimuck Dulla at 45 Rs. 4 As. per Candy.					
		Quantity.			Value.			Quantity.			Value.		
		Cds.	M.	S.	Rs.	A.	P.	Cds.	M.	S.	Rs.	A.	P.
Under Raie Bul Mookadum Talookdar.	1252 Fuslee.	3	1	30	175	15	3	2	7	10	106	14	6
	1253 Fuslee.	7	10	35	429	15	6	5	3	26¼	234	8	9
	1254 Fuslee.	3	7	0	190	15	3	18	16	0	850	11	3
	1255 Fuslee.	2	15	30	158	14	6	9	14	0	438	14	9
	1256 Fuslee.	15	18	38¼	909	1	6	20	14	26¼	938	12	0
	Total.	32	14	13¼	1,864	14	0	56	15	22½	2,569	13	3
Under Meer Mohib Ale Khan Talookdar.	1256 Fuslee...	0	0	0	0	0	0	20	13	10	934	15	6
	1257 Fuslee...	30	5	10	1,724	15	6	9	15	0	441	3	0
	1258 Fuslee...	8	8	0	478	13	0	2	13	6¼	120	4	9
	1259 Fuslee...	0	0	0	0	0	0	0	0	0	0	0	0
	1260 Fuslee...	0	0	0	0	0	0	0	0	0	0	0	0
	Total.	38	13	10	2,203	12	6	33	1	16¼	1,496	7	3
	Grand Total.	71	7	23¼	4,068	10	6	89	16	38¾	4,066	4	6

uslee 1252 *or A. D.* 1836-1837, *under the Nizam's Government.*

Choorah at 39 Rupees 8 Annas per Candy.						Khuppul at 35 Rupees per Candy.						Pupprec at 22 Rupees 4 Annas per Candy.					
Quantity.			Value.			Quantity.			Value.			Quantity.			Value.		
Cds.	M.	S.	Rs.	A.	P.	Cds.	M.	S.	Rs.	A.	P.	Cds.	M.	S.	Rs.	A.	P.
81	8	0	3,215	4	0	177	11	16	6,214	11	0	62	19	20	1,401	3	0
41	2	6¼	1,623	11	9	67	3	0	2,350	4	0	60	8	12½	1,344	4	0
67	15	0	2,676	2	0	105	16	26¼	3,704	2	6	131	4	32½	2,920	1	9
54	16	0	2,164	10	6	46	13	0	1,632	12	0	145	7	0	3,234	0	9
26	3	12½	1,033	8	0	37	2	0	1,298	8	0	105	2	0	2,338	7	6
271	4	18¾	10,713	4	3	434	5	36¼	15,200	5	6	505	1	25	11,238	1	0
8	2	0	319	15	0	3	15	30	132	9	0	71	14	10	1,595	9	9
29	5	0	1,155	6	0	16	4	0	567	0	0	227	16	0	5,068	9	0
9	5	34¼	367	1	0	3	7	12½	117	12	9	127	0	26¼	2,828	4	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	12	34¼	1,842	6	0	23	7	2½	817	5	9	426	10	36¼	9,492	6	9
317	17	13	12,555	10	3	457	12	38¾	16,017	11	3	931	12	21¼	20,730	7	9

Mixed Ammuis Puppree at Rs. 17-4-0 per Candy.						Bhooskee.											
Quantity.			Value.			Quantity.			Value at Rs. 7-10-0 per Candy.			Value at Rs 10-14-9 per Candy.			Value at Rs 11-14-0 per Candy.		
Cds.	M.	S.	Rs.	A.	P.	Cds.	M.	S.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.
0	0	0	0	0	0	60	1	10	457	15	9	0	0	0	0	0	0
0	8	6¼	7	0	0	29	14	6¼	226	8	6	0	0	0	0	0	0
9	13	35	167	4	3	43	6	0	330	3	0	0	0	0	0	0	0
2	18	10	50	3	6	26	19	10	148	12	9	81	5	9	0	0	0
4	12	0	79	6	3	21	4	0	0	0	0	0	0	0	251	12	0
17	12	11¼	303	14	0	181	4	26¼	1,163	8	0	81	5	9	251	12	0
1	2	0	18	15	6	6	7	0	0	0	0	0	0	0	75	6	6
8	2	25	140	4	0	15	1	30	0	0	0	0	0	0	179	2	6
0	16	12½	14	1	3	25	12	0	0	0	0	0	0	0	304	0	0
0	0	0	0	0	0	0	18	20	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	6	5	30	0	0	0	68	10	9	0	0	0
10	0	37½	173	4	9	54	5	0	0	0	0	68	10	9	558	9	0
27	13	8¾	477	2	9	235	9	26¼	1,163	8	0	150	0	6	810	5	0

						Madkhar.														
Value at Rs 20-14-0 per Candy.			Total Value.			Quantity.			Value at Rs. 3-15-0 per Candy			Value at Rs. 8-5-0 per Candy			Total Value.					
Rs.	A.	P.	Rs.	A.	P.	Cds.	M.	S.	Rs.	A.	P.	Rs.	A.	P.	Rs.	A.	P.			
0	0	0	457	15	9	0	0	0	0	0	0	0	0	0	0	0	0			
0	0	0	226	8	6	0	0	0	0	0	0	0	0	0	0	0	0			
0	0	0	330	3	0	0	0	0	0	0	0	0	0	0	0	0	0			
0	0	0	230	2	6	0	0	0	0	0	0	0	0	0	0	0	0			
0	0	0	251	12	0	0	0	0	0	0	0	0	0	0	0	0	0			
0	0	0	1,496	9	9	0	0	0	0	0	0	0	0	0	0	0	0			
0	0	0	75	6	6	0	0	0	0	0	0	0	0	0	0	0	0			
0	0	0	179	2	6	4	2	25	16	4	3	0	0	0	16	4	3			
0	0	0	304	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
19	5	3	19	5	3	0	0	0	0	0	0	0	0	0	0	0	0			
0	0	0	68	10	9	0	13	30	0	0	0	5	11	3	5	11	3			
19	5	3	646	9	0	4	16	15	16	4	3	5	11	3	21	15	6			
19	5	3	2,143	2	9	4	16	15	16	4	3	5	11	3	21	15	6			

Grand Total. Quantity of Salt. Cds.	M.	S.	Grand Total. Value. Rs.	A.	P.	Deduct Charrum or $\frac{1}{4}$ share to parties employed in extracting the Salt. Rs.	A.	P.	Government Share. Rs.	A.	P.	Remarks.
387	9	0	11,571	15	6	2,892	15	9	8,678	15	9	
211	10	12½	6,216	4	6	1,554	1	3	4,662	3	9	240 Seers to the Candy or 12 Seers to the Maund.
379	19	13¾	10,839	8	0	2,709	14	0	8,129	10	0	
289	3	10	7,909	10	6	1,977	6	6	5,932	4	0	
230	16	37½	6,849	7	3	1,712	5	9	5,137	1	6	
1,498	18	33¾	43,386	13	9	10,846	11	3	32,540	2	6	
101	14	10	3,077	7	3	769	5	9	2,308	1	6	
340	12	10	9,292	12	3	2,323	3	0	6,969	9	3	
177	3	11¼	4,230	4	9	1,057	9	3	3,172	11	6	
0	18	20	19	5	3	4	13	3	14	8	0	
6	19	20	74	6	0	18	9	6	55	12	6	
637	7	31¾	16,694	3	6	4,173	8	9	12,520	10	9	
2,136	6	25½	60,081	1	3	15,020	4	0	45,060	13	3	

APPENDIX No. 2.

STATEMENT *of Receipts and Disbursements on account of Salt extracted from the Lake of Loonar in the months of April, May, June, and 20 days in July* 1855, *as an experiment.*

RECEIPTS.	Rs.	a.	p.	DISBURSEMENTS.	Amount in Hyderabad Rupees.			Total.		
35 Candies of Salt extracted from the Loonar Lake of the description named, Dulla, Khuppul, and Puppree, at Rups. 41, 12 Annas per Candy of 340 Seers	1,461	4	0	Paid to Drivers being one-fourth (Charum) for extracting the salt from the Lake agreeably to former usage	365	5	0			
				Russooms to Zemindars on the net produce at 5 per cent. agreeably to former usage . .	47	8	0			
				Russooms to Putwarrie on the net produce at $2\frac{1}{2}$ per cent. agreeably to former usage . .	23	12	0			
				Pay to Khamdar for Superintendence for the months of April, May, June and 20 days in July 1855, at 10 Rupees per month . . .	36	7	3			
				Purchase of 3 Candies	33	10	3			
				For ceremonies previous to diving agreeably to usage	10	5	3			
				Making up 2 cots to float on the Lake . .	4	0	0			
				40 Baskets	0	6	0			
				Scales for weighing	0	8	0			
				Hire to weighers	0	12	0	522	9	9
				Balance carried to credit of Government . .	......	..	..	938	10	3
Grand Total Hyderabad Rupees	1,461	4	0	Grand Total Hyderabad Rupees . .	......	..	..	1,461	4	0

APPENDIX No. 3.

ANALYSIS OF DULLA SALT BY MR. REYNOLDS, AN ANALYTICAL CHEMIST OF CLAPHAM.

Extracted from Surgeon BRADLEY'S *Memoir—page* 62.

Dulla.

Soda.............	32.8	} 67.
Carbonic Acid	34.2	
Water............	31.	
Chloride of Sodium	2.	
Alumia, a trace.		
	100.	

67 of the Sesqui-Carbonate—equivalent to 56 per cent. of the Neutral Carbonate of Soda.

Khuppul.

Less soluble than Dulla—the equivalent of 52 per cent. of Neutral Carbonate being present.

Lake water.

Specific gravity 1,059 (Bradley) Analysis of the Lake water (Malcolmson.)

In 1,000 grains.

Chloride of Sodium........	29. grains.
Sesqui Carb : of Soda......	4.2
Sulphate of Soda..........	0.1
Potass, a trace.	

Specific gravity.

1. of water from the Cow's mouth...........	1,000	} at 85° F.
2. from Loonar Lake......................	1,060	
3. from Bowrie of Sweet water in the Lake....	1,000	

APPENDIX No. 4.

Trees found in the crater of Loonar (authority Surgeon BRADLEY.)

1. Sterculia urens.
2. Boswellia serrata.
3. Grislea tomentosa.
4. Cochlospermum gossypium.
5. Borassus flabelliformis.
6. Tamarindus Indica.
7. Mangifera Indica.
8. Anona reticulata.
9. Anona squamosa.
10. Michelia Rheedii.

11. Conocarpus latifolia.
12. Lagerstrœmia parviflora.
13. Melia Azadirachta.
14. Butea frondosa.
15. Dalbergia.
16. Cathartocarpus Fistula.
17. Bauhinia tomentosa.
18. Prosopis spicigera.
19. Acacia Smithiana.
20. Mimosa.
21. Poinciana pulcherrima.
22. Buchanania latifolia.
23. Feronia Elephantum.
24. Grewia ulmifolia.
25. Helicteres Isora.
26. Capparis horrida.
27. Combretum acuminatum.
28. Clematis Gouriana.
29. Flacourtia sepiaria.
30. Celastrus montana.
31. Zizyphus (3 var.)
32. Abrus precatorius.
33. Ficus Indica.
34. —— religiosa.
35. —— glomerata.
36. Clerodendron phlomoides.
37. Dodonœa Burmanniana.
38. Tectona grandis.

Report on the Chemical Examination of several specimens of Salt from the Loonar Lake in the Deccan, by J. E. MAYER, *Professor of Chemistry, Madras.*

Qualitative Examination of Salt No. 1 "Dulla."

A portion, not weighed, treated by dilute sulphuric acid gave off a very large quantity of carbonic acid, leaving a notable portion of impurities undissolved, consisting of dirt, earth and some organic matters; these were separated by filtration. A portion of the filtrate ascertained to be acid, was then treated by solution of nitrate of silver, a copious white precipitate was deposited, showing the presence of chlorine. A second portion of the filtered solution was neutralized by solution of ammonia, iron and alumina were thrown down in small quantity: the precipitate was separated by filtration; to the filtrate, solution of oxalate of ammonia was added, white precipitate took place; this was separated by filtration, and to the filtered solution, phosphate of soda was added, a small crystalline precipitate occurred.

A fresh portion of salt taken and tested by the blow pipe for the presence of soda, gave the characteristic flame; the only base that could be left being potash, it was passed over (as if present it could only be in small quantity) till the quantitative examination was carried out.

A fresh portion of salt was dissolved, and treated by a little nitric acid; after effervescence and filtration, solution of nitrate of baryta was added—no reaction—absent sulphuric acid. Phosphoric acid being evidently in small quantity, if present at all, was not looked for. The preliminary examination of each sample of salt was conducted in a similar manner.

Guided by the qualitative examination above shown, the quantitative determinations were carried out. The usual methods adopted by chemists were employed throughout in these determinations. To ascertain the constitution of the salt, some special experiments were required. Frezenius and Will's method for the determination of the carbonic acid was made use of, to ascertain whether it was really a sesquicarbonate with the formula 2 NaO, 3 CO_2 like the natural compounds of soda and carbonic acid in Africa, or whether it had the more ordinary formula of the neutral or bicarbonate. These experiments showed in the case of the "Dulla" salt, that there is a mixture of carbonate and sesquicarbonate, in the proportion of 54 per cent. of the neutral carbonate and 30 per cent. of the sesquicarbonate; but in the others, a neutral constitution was found to exist, as exhibited by the formula NaO, CO_2. The point of interest connected with the constitution of the Dulla salt is purely a scientific one, since natural sesquicarbonates are very rare, having hitherto been found only in Fezzan in Africa, in the soda lakes of Hungary, and in Venezuela, South America; to this list we may now however add the Loonar lake in the Nizam's country. An artificial sesquicarbonate can only be obtained with difficulty, and under certain conditions involving a very careful employment of temperature.

The following is a statement of the composition of the several specimens of salts from the Loonar lake, calculated on 100 parts.

No. 1. "Dulla."

Carbonic acid..........	38·00	83·82; equal to 77·30 of neutral carbonate consisting of— 31·48 of carbonic acid 45·82 of soda. —— 77·30 neutral carbonate anhydrous.
Soda................	45·82	

Chlorides of sodium and calceum.............	0·61
Insoluble matter, trace of iron, alumina, and organic matter.........	2·00
Water.................	13·57
	100·00

No. 2. "Nimuck Dulla."

Nearly pure common salt, containing 92·88 per cent. of chloride of sodium.

No. 3. "Khuppul."

Carbonic acid..........	32·0	72·58; equal to 68·47 of neutral carbonate consisting of— 27·89 of carbonic acid, 40·58 of soda. —— 68·47 of carbonate of soda.
Soda.................	40·58	
Chloride of sodium.....	0·53	
Water................	25·09	
Insoluble matter........	1·80	
	100·90	

No. 4. "Puppree."

Carbonic acid..........	29·00	72·46; equal to 71·1 of neutral carbonate consisting of— 29· of CO_2, 42·1 of soda. —— 71·1 of neutral carbonate.
Soda.................	43·46	
Chloride of sodium.....	0·40	
Insoluble matter........	0·80	
Water................	26·34	
	100·00	

No. 5. "Madkhar."

Neutral carbonate of soda	27·0	Carbonic acid..	11
		Soda..........	16
			27
Insoluble matter, consisting of clay, sand, &c...	30·4		
Water................	16·4		
* Common salt.........	25·4	Mean of 2 experiments.	
	99·2		

No. 6. "Bhooskee."

Neutral carbonate of soda	26·0	Carbonic acid..	10·6
		Soda..........	15·4
			26·0
Insoluble matter, consisting of sand, clay, &c..	58·0		
Water................	15·4		
Soluble impurities, chloride of sodium chiefly..	2·6		
	100·		

No. 7. "Travertin."

Carbonate of lime......	78·00
Do. of magnesia..	4·58
Insoluble matter, oxide of iron, &c.............	9·00
Chloride of sodium.....	2·60
Water................	3·80
	97·98

* The common salt in the sample is not uniform in quantity.

No. 8. Quartz.

No. 9. Greenish brown glass, very fusible.

No. 1. This salt appears to be formed in crystalline masses, and is but slightly contaminated by chloride of sodium, or by any other insoluble impurities; these, exclusive of the water present, will amount to about 4 per cent.

No. 2. Fine cubical crystals, forming masses, in which the peculiar structure may easily be traced; this salt contains something more than 92 per cent. of common salt, or chloride of sodium.

No. 3. Has less crystalline structure than No. 1; is efflorescent and white in appearance. Chemical constitution shows a larger amount of water, while the soda and carbonic acid are nearly in the proportions required to form neutral carbonate.

No. 4 is formed by the aggregation of numerous small crystals, is whiter than No. 1, but has almost the same chemical constitution as No. 3.

No. 5 appears in larger dirty looking masses, is not homogeneous in its composition; in parts, it possesses a beautiful structure, seen in crystals radiating from a centre: contains 16 per cent. of water, 25 per cent. of common salt, and 30 per cent. of insoluble impurities.

No. 6. A greyish looking earth, containing 58 per cent. of insoluble impurities, 15 per cent. of water, 2½ of common salt, leaving 26 per cent. of carbonate of soda.

No. 7. A salt varying from all the other specimens, being composed of earthy (not alkaline) carbonates chiefly, some insoluble impurities, a little common salt.

No. 8 not examined, it evidently consists of crystallized silicic acid, known as quartz.

No. 9. A readily fusible glass, most probably chiefly a silicate of soda, not examined chemically, scratches window glass.

I have made no remarks respecting commercial value, as this must necessarily depend on various circumstances, concerning

which I am but partially informed; these will chiefly embrace 1st, the present quantity available for the market: 2nd, constancy of the supply: 3rd, local demands for the salts, which can only be known to those residing near the lake: 4th, means of transit, should a demand exist or arise elsewhere: 5th, the small probability of bringing any natural carbonate from a distance to compete in Europe, with the carbonate of soda made from common salt by Leblanc's process: 6th, the want of any extensive Indian manufactories of glass or soap, for which in Europe alkaline carbonates are principally employed.

The foregoing observations apply more or less strongly to all the samples containing carbonate of soda. The sample No. 2, which is essentially a pure rock salt, deserves more consideration, as it might, supposing it to exist in quantity, be turned to account as a source of revenue; there being always, from the large consumption and high price of the article, a ready market for good common salt in India. Sample No. 7 is worth a trial for building purposes, provided that the common salt present could be eliminated by washing.

The purification of the salts Nos. 1, 3 and 4 is easily effected by simple solution in hot soft drinking water, decanting or syphoning off the supernatant clear fluid to separate insoluble impurities, and evaporating in cast iron or sheet iron pans by means of furnace heat. As to whether the purification would prove profitable or not will depend on the expense incurred for fuel and cooly hire, and the price of the evaporating pans, together with that of the purified article; the latter is a main point to be considered, and cannot be seen before hand.

No. 2 requires little or no purification.

No. 5 might be purified in the same manner as Nos. 1, 3 and 4. There will exist in solution, a mixture of common salt and carbonate of soda, the former averaging about 25 per cent.; by concentration of the solution, (which should also be effected in iron pans), the common salt, from its less solubility compared with the carbonate of soda, and its equal solubility in both hot and cold water,

will subside to the bottom of the evaporating vessel; it can be removed by means of a colander, drained, subsequently washed and dried; the solution will then contain carbonate of soda chiefly; by further concentration it will crystallize. A second solution of the carbonate in a limited quantity of water, and evaporation, will give crystals in a pretty pure state.

If it be considered worth while to purify salt No. 5, it must be chiefly for the purpose of extracting the common salt it contains, for which a ready market exists in this country; in doing so, however, the price of the article so obtained should be weighed against the selling value of this article obtained by solar evaporation from sea water or brine springs.

II. *Notes on Indian Currencies. By* J. W. BREEKS, *of the Madras Civil Service.*

Of all countries, Egypt perhaps excepted, the history of none retrogrades so far into the mist of fable and tradition as the Mythological Stories of Hindostan. The four great ages or Yugs of the Satya, the Treta, the Dwapa and the Cali descriptively distinguished as the Golden, the Silver, the Copper and the Earthen, introduce us to a most extravagant antiquity and represent every occurrence in a drapery of marvel and allegory under a regime of Solar and Lunar Kings.

Out of such fabulous materials to hazard an opinion as to whether the use of a *currency** was understood in those times, would be folly. Even in Menu's Code written in all probability 10 or 11 centuries B. C., the existence of a recognised Currency is alluded to in as familiar a manner, as a modern author might tell of a pound weight, or a yard measure at the present day.

In one part of the venerable volume, we find the interest of money judiciously regulated at x for the Twice-Born, and 2 x for

* When the term "money" or "currency" occurs, it is not restricted to Coin Stamped by Public Authority, but includes also metal and other substances used as a medium of trade.

other people, while another part is devoted to a description of the provisions to be observed in suits for recovery of debts and such actionable matters, all of which are enumerated with the most punctilious nicety.

In a chapter* on Judicature and on Law, Private and Criminal, it is ordered, that " a false witness speaking falsely through covetousness shall be fined a 100 *panas*, through distraction of mind 250."

Such examples may be multiplied *ad libitum* through the 12 books of the Institutes : when we have these illustrations so to speak, depicting the highly civilized and social position of the Hindoos certainly 3,000 years ago, to hope for any trustworthy accounts of what may have taken place anterior to that period respecting even so obvious and familiar a topic as money would be vain.

One thing is certain, a very advanced state of civilization obtained among Hindoos in very ancient times, certainly before Troy was besieged, probably when Theseus reigned in Athens, or when Abraham visited Egypt, and the further into antiquity the thread of their history extends, we are less likely to find any trusty information of their adoption of a circulating medium and the surrounding causes that led to it.

All that can now confidently be asserted is, that the precious metals were anciently found in India in great abundance, and that when in the course of nature the want of a currency made itself felt, a wide choice of qualified substances was available.

Without drawing at present upon the earlier accounts which pretty generally hold India to be the fountain of everything precious, there are to be found in more modern times numerous allusions in the manifold histories of India to the existence of its riches, and to mines of precious ores and stones.

Abul Fazl (Akbar's Prime Minister) in the Ayeen II, p. 47 speaks of the iron mines of Gwalior, of the profitable and rich copper works of Beerat and of a silver mine not worth mentioning.

* Ch. viii. para 120.

In a supplement to a voyage to the East Indies, written by Monsieur Dillon in 1698, an account is given of the wealth of the Great Mogul, and that "he wore upon his arm a diamond of inestimable value being as big as a pullet's egg. This diamond was "stolen out of the diamond mines belonging to the king of Bisnagar, betwixt Tonquin and Pegu, where every day are 20,000 men "at work. The king reserves all the best diamonds for his own "use, which are not to be sold. The best of those we have in "Europe being only looked upon as inconsiderable, are sold to the "European merchants."

Heyne also in his "Tracts on India" has described his visit in 1795 to the diamond mines in Ellore, and various parts of the Ceded Districts—and we all know Pope's account of Governor Pitt and the Golconda diamond he bought from the Brahmin—

> "Asleep and naked as the Indian lay,
> "An honest factor stole the gem away."

It is a widely known fact, however, that Indian gold and silver and minerals generally have not hitherto received much attention from scientific men, notwithstanding that their value has been appreciated from time immemorial by the Hindoos, and the metals have been in very common use amongst them for ornament and exchange for ages back, as is evident by their own and Grecian writings and consequently indisputable.

Take for example the Chetri Ganitam written originally in Sanscrit "the language of the gods," and quoted by Heyne, one part of which, the Suvarnah Ganitam teaches the art of assaying gold and silver by the touch, and of taking their specific gravities.

Heeren vol. i. p. 280.
Herodotus iii. 102: 106.

Herodotus also (who wrote about 5 centuries B. C.) tells a pretty story about the way in which the Indians procured their gold in his time—

"There are other Indians living near the city of Caspatyras and "the country of Pactyica (the city and territory of Cabul) situated "to the North of the rest of the Indian nation, and resembling the "Bactrians their neighbours in their manner of life. These are "the most warlike of all the Indians, and the people who go to "procure the Gold. For in the neighbourhood of this nation is a

" sandy desert in which are ants less in size than dogs, but larger " than foxes, specimens of which are to be seen at the residence " of the King of Persia, having been brought from that country. " These creatures make themselves habitations under ground " throwing up the sand like the ants in Greece, which they " nearly resemble in appearance. The sand however consists of " gold dust. To procure this, the Indians make incursions into " the desert taking with them three camels, a male one on each side " and a female in the centre on which the rider sits, taking care " to choose one which has recently foaled. When in this manner " they come to the place where the ants are, the Indians fill their " sacks with the sand and ride back as fast as they can, the ants " pursuing them as the Persians say by the scent, the female camel " eager to join her young one surpassing the others in speed and " perseverance. It is thus according to the Persians that the In- " dians obtain the greater part of their gold, at the same time " that the metal is also found though in less quantities in mines."

As something akin to this I may insert here Monsieur Dillon's account of Calicut, and the wonderful gold-yielding properties of the Sands there.

" Among the sands of the shore, there is good store of gold-dust " which is very fine, and everybody has the freedom to gather it " at pleasure : the biggest piece that ere I saw was not worth above " 15 pence, and commonly they are not worth above 4 or 5 pence " a piece ; abundance of people get a livelihood by it ; and with " the consent of the Governor (which is to be purchased by a cer- " tain set price, for the maintenance of a hundred poor people) you " may have as much sand as you please carried to your dwelling " places in order to separate it with the most convenience.

Also Pennant in his "Hindostan" written about 1798 A. D., at page 41 relates, that "Abul Fazl (II. 223) speaking of the rivers " of this country (Lahore) says, that the natives by washing the " sands obtain gold, silver, copper, rowny, tin, brass and lead. " Rowny is unknown to me, brass is fictitious."

Heeren whom I have quoted before, mentions in his 1st volume that the Hindoos were the only people subject to the Persian Em-

pire who paid their tribute in gold, and not in silver. In his 3d volume, page 357, speaking directly of the ancient Indian currency, he says, "There is no doubt that the precious metals gold and "silver, particularly gold, were in very ancient times the established "medium of exchange in India; but this however will not prove it "to have been coined. If we can repose any confidence in the "published translations of native works, the use of coined money "would appear to have prevailed in very remote times, for it is "expressly mentioned in the fable of Krishna; but it is uncertain "whether the passage is taken from the Mahabarat* or the Bha-"gavat,† or from one of the other Puranas.‡ In the laws of Menu "the respective weights of *paras* and *racticas* of copper, silver "and gold, are very exactly determined, without however any allu-"sion to their being stamped. But whatever may have been the "value and character of the ancient Hindoo coinage, it is quite "certain that its use is of very remote antiquity."

It is but candid however to own, that it is difficult to reconcile this with the foot note, wherein the author seems to confess, he can find no very reliable information for such remote antiquity, for he asks—

"Is there even any Hindoo coinage older than our æra? we "certainly know of none. There are indeed plenty of coins im-"pressed with some emblematical device, but none of them have "either date or inscription of any kind."

In the Greek accounts of India as gathered from Maurice's and Elphinstone's histories—in Strabo's account of Alexander's invasion B. C. 327, a description is given of the habits and manners of the natives of India, presenting a picture very similar to what we find in the Southern parts of the Peninsula in our own time, and that "they wore gold and jewels, and were very expensive in their dresses, though frugal in most other things."

From the kingdom of Bactria founded by a detachment of Alexander's army, and which according to Clinton's Fasti Hellenici

* Familiar to the Hindoos 2 or 3 centuries B. C.

† The Bhagavat is an episode of the same poem.

‡ Of more modern date, written probably between the 8th and 16th centuries A. D.

lasted about 120 or 130 years, and terminated about B. C. 120 or 130, many coins have found their way into India, and have been dug out from time to time about Cabul and Peshawur, and "one as far East as Muttra on the Jumna."—See Elphinstone's History of India, Appendix iv. p. 247. 3d edition.

A better and more complete account however of Alexander's invasion, and of the Grœco-Parthian kingdom after his time, of which Bactria was only an independent Satrapy, is given in Prinsep's Historical accounts from Bactrian coins and in Professor Wilson's book on Bactrian numismatics. Previous to the researches of these two gentlemen, our acquaintance with the Grœco-Asiatic currency was confined to a stray coin or two which had turned up par hazard here and there; but now by their study and inquiry upon fresh discoveries, that acquaintance has grown into a considerable chronological knowledge, not only of the order of the kings, but of the general history of that part of the country from Alexander's invasion to A. D. 215, the end of the Grœco-Parthian dominion.

Pennant in his Hindostan, page 70, speaking of a place on the gulf of Cambay, North of Surat, called Barochia probably the ancient Barygaza, the greatest emporium of all India in ancient times, says—

"Numbers of ancient drachmæ have been found here, inscribed "with Greek letters and the names of Apollodotus* and Menander,† "king of Bactria, who also reigned in this part of India."

Also, in page 78, talking of Ougein, a city north of the Nerbudda and supposed to be Ozene in Arrians Periplus‡, having just described a vasa myrrhina or drinking cup of T. Petronius made of a stone called myrrhine from Ougein, and described by Pliny—he (Pennant) says—"Even in those early times the merchants had "their course of exchange, and made great profit by the change "of the gold and silver denarii§ for the money of the country."

* B. C. 135

† B. C. 155, according to Prinsep's Historical Results from Bactrian coins.

‡ Written about A. D. 30.

§ Prinsep in vol. i. p. 396 of the Journal of the Asiatic Society, for September 1832, says the Denarius was the principal silver coin of the republic—and weighed 90 grains—but was reduced by Augustus to 60 and by Constantine to 40 who also hanged its name to Centionalis, because 100 pieces equalled 1 lb. of silver.

Also, in page 51 vol. II. writing of Sadras, he says, " That this " was a place of commerce I little doubt, and probably frequented " by the Romans. The grounds of my conjecture are that a pot of " gold and silver coins* has been found here by a Ryot, with cha- " racters which neither Hindoos nor Mahomedans could explain. " They probably must be Roman. We know that their trade ex- " tended even farther than the Coromandel Coast, and I have also " been informed that Roman coins have been seen in the possession " of Brahmins, the only people of curiosity in all these extensive " regions and such coins must have been found within their " neighbourhood."

In spite, then, of those who would have us believe that Akbar was the first to coin gold and silver money, it is evident that the precious metals have been known to the Hindoos from a very remote æra, certainly since the Grœcian invasion, and being eminently qualified for a circulating medium, became centuries ago, as Turgot has observed, " universal money not in consequence of " any arbitrary agreement among men, or of the intervention of " any law, but by the nature and force of things," throughout the peninsula of India as well as every where else, but at what precise period remains unknown. That the choice fell upon gold and silver arose probably from their being obtainable in the country, from their possessing the requisite qualifications of durability and divisibility, from their great intrinsic value, and from their having been extensively used for personal ornaments, the former metal in particular, because more portable and in the absence of banks and such like places of deposit more suitable for hoarding. The practice of hoarding jewels and gold is very common now in the interior, probably as much so as it ever was, and a good modern instance of it is given by Schomberg in his account of Runjeet Sing and his search after his chief Moonshee's treasures. The extract is subjoined. " A tomb was erected in the interior of the Moonshee's " house, ostensibly to honor his father's memory, but in reality to " conceal his treasures, which when it was opened was found to " contain not a smouldering skeleton but solid gold. There are

* Asiatic Researches I. 158.

" to be seen in India bars of pure gold melted into a solid mass, " and to which the Indians give a name that might very well be " translated gold bricks. Under the floor of the Moonshee's " private room was found a flooring of these gold bricks, the walls " were filled with them, the beams of the rooms were hollowed out " and stuffed with the same precious metal."

Everywhere in the early and uncultivated ages of a nation, before Fable has run into History, and Money driven out its cumbersome antecedent Barter ; when as yet Capital and Commerce are too feeble to call into action that army of competing interests and trades, so fruitful in the invention of measures to facilitate the interchange of commodities ; when as yet that chimerical gentleman was daily to be met with,

——— Whose wish and care
A few paternal acres bound,
Content to breathe his native air
in his own ground.

Whose herds with milk whose fields with bread,
Whose flocks supply him with attire,
Whose trees in summer yield him shade,
in winter fire.

When it was an ordinary incident, to see men, glad to satisfy their few wants by an exchange of the productions themselves with the services and commodities of their surrounding neighbours, no necessity for a circulating medium existed: and there must first arise a variety of transferable commodities, and a succession of different wants before such necessity can have existence.

But as time hurries on, and the nation gathers strength, and war obliges intercourse with other nations, the people's wants insensibly increase and certain necessities stealthily creep in, *aurâ leni*, as it were, amongst which that of a more frequent interchange of commodities is always in the van, and the convenience not to say necessity of adopting some substance to facilitate the general transfer of services and commodities, and to be a measure of value and an evidence of debt, as obviously arises in the advancing tide of that nation's knowledge, as motion is created by force, and

certain uniform effects follow certain causes in any of the physical sciences.

With a nation emerging from barbarism, as soon as a variety of productions and a multiplicity of wants have reached a certain pitch, the fact that Money will supplant the intricate and circuitous method of Barter, is as much an intrinsic axiom in Pecunio-Economy, as that 2 and 2 make 4 in Arithmetic.

Acquaintance with the early history of nations assures us that such a result will always follow; for have not all nations adopted an intermediary currency at one period or another of their rise into national importance?

The metal employed may vary, as frequently, as there are or have been nations and as best adapted to their varying resources and circumstances, nevertheless every one of them have at some period of their course adopted some, silver—some, copper—some, iron* and some, gold—some, leather and some, shells—some, tobacco and some, salt—some, beads and some, slaves; but all have employed a currency as a measure of value to represent capital, the accumulation of labor, and to promote the transfer of commodities and mutual exchanges; and the institution of money may be considered as natural a result of a certain posture of circumstances in a nation's existence, as activity and buoyancy are the natural result of youth in an individual.

For a good account of the different substances used as currency in different countries, from the time Abraham bought his field for 400 shekels of silver down to the new Florin of Victoria, see the III. chapter of a book lately published called McCleod's Theory and Practice of Banking.

With nearly all nations metal will be found to have been the substance employed, from its possession, as I have said before, of a certain intrinsic value and of properties such that any fixed weight of metal (A) being held to represent a certain fixed value (B)

* Lycurgus established an iron currency, to lay up 10 minæ of which (£85-5-10) a whole room was required and to remove it at least a yoke of oxen to the end that by continuing poor, the Spartans, were best guarded against the invasion of an enemy.

certain parts of (A) can be made to represent the like parts of (B) proportionally.

Not that it is absolutely necessary that the currency should be of metal—it may consist of what apparently has no value, as shells, or beans; and it may consist of precious stones, or even of paper as far as the home circulation is concerned.

Mr. Ricardo in 1819 suggested some such paper plan to the famous Bullion Committee, and maintained that the circulation of England should consist of nothing but paper and small silver tokens, the Bank issuing the paper and being compelled to pay its notes above a certain amount (£100 I think) in bullion instead of coin, and that there should be no gold coin at all. But such currency schemes based upon credit for the purpose of economizing bullion can only be carried out in countries very far advanced in civilization, where men have considerable confidence in one another, and entire faith in the stability of Government; while, in a country's infancy, on the other hand, where no such feeling is at all universal, it is very essential that the circulating medium should itself possess a certain intrinsic value, and for convenience and utility's sake be divisible, durable and of uniform texture—whence it comes that value has been always estimated by weight and not by tale, and gold and silver have been the favorite metals.

In so vast an agricultural country as India, where from time out of mind, the people have been caste ridden, where labor has been abundant and wages wretchedly low under governments despotic and changeable, and where there has been considerable internal trade, and where if we make exception in the matter of dyes, precious stones, and gold dust, which the ancients tell us came from countries near the source of the Indus, there was anciently no foreign commerce of importance the great majority of payments must always have been made in small coin, and though gold may at the same time have been abundant, for one instance of a tender of a gold piece, innumerable calls must have existed in such a country for a small silver or copper currency.

Mills in his history of British India supports this inference, (though he entirely disbelieves that the people of Hindostan were in remote times profusely supplied with gold and silver, as proved he argues, by the traffic of India being chiefly one of barter and its taxes being paid in kind,) where he says "It was not till "the time of Akbar that gold or silver was coined for circulation "in the principal parts of India, antecedently to that period *small* "*pieces of copper* being the only coin," to which in a note is added "—See the analysis of Tooril Mull's system of Finance in British "India analysed—1. p. 191. These copper pieces were called *pul*-"*siah* or *feloos*, 16 of which were reckoned equal to a Tankah "of bare silver, a sort of coin or rather medal sometimes struck "at the pleasure of the King, not for use but to make presents to "foreign ambassadors and others. In the Deccan, a gold and "silver coin was known earlier; which the same author thinks "must have been introduced by the intercourse of the Persians "and Arabians, to whom the use of the coin had been known "nearly a 1,000 years before."

But I agree with Mr. Elphinstone that the coinage of gold and silver must have been very general throughout India long anterior to Akbar's time, and was probably derived from the Greek colonies in Bactria, two or three centuries B. C., though it is not unlikely that with the precious metals as their standards of value the *general* circulation consisted of a cheaper money. One can understand that much more use would be found for tokens of copper and such media, as better suited to the wants of the people and to answer the purpose of a subsidiary coinage.

Stavorinus in his voyage to the East Indies (vol. I. p. 401) from 1768 to 1771 mentions that, "copper coin is not seen in Bengal. "For change they make use of the small sea shells called cowries, "80 of which make a *poni* and 60 or 65 *ponis*, according as there "are few or many cowries in the country, make a rupee. They "come from the Maldive islands. The money changers sit upon "all the bazaars with quantities of them to furnish the lower or-"ders with change, for the purpose of necessaries." Again,

(vol. III. p. 9) talking of the Surat currency the same Author says, "in the same way as cowries are made use of in Bengal, "almonds called badams are made use of here," to which the Translator in a foot-note adds, "when Ovington was at Surat about "60 bitter almonds was the current rate of a pice. Thevenot says "68, and adds, that the almonds that pass for money at Surat come "from Persia and are the fruit of a shrub that grows on the rocks."

Vide "Hindostan," p.151.

Pennant has described the way in which the cowries are obtained.

"These shells are collected twice in the month at full and new "moon. It is the business of the women who wade up to their "middle to gather them. They are packed up in parcels of "12,000 each, and are the current money among the poor in Ben-"gal. Hamilton mistakes the manner of gathering them when "he says—The natives fling into the sea branches of coco trees, "to which the shells adhere and are collected every 4 or 5 months. "The exchange for them from Bengal is rice, butter and cloth."

With regard to Akbar being the first to coin silver and gold, Elphinstone (p. 428) says, "it has been said that Akbar first coin-"ed silver and gold money. The assertion is inconsistent with all "history. If the Hindus had not a coinage in those metals earli-"er, they at least adopted it from the Bactrian Greeks about the "beginning of the Christian æra."

Mr. Charles Masson in the Journal* of the Asiatic Society of Bengal for September 1836, treating of certain coins found at Beghram, in Cabul, classifies them into five grand divisions.

1. Grœco-Bactrian.
2. Indo Scythic or Mithraic.
3. Ancient Persian, whether Parthian or Sassanian.
4. Hindu or Brahminical.
5. Kufic or Mahommedan.

Thus commencing with the third Century B. C. we have a succession of coins varying in their form and superscription accord-

* Vol. v. p. 537.

ing to the dynasty that issued them, from that time to close upon the Mahommedan æra.

In the same Journal* for October 1836, Mr. Prinsep has given several new varieties of the Indo-Scythic coins and more fully developed the link between that coinage and the Hindu series, through the Gupta coins of Canouj. And in the April number of the Journal for 1837, the same gentleman has engraved specimens of the Indo-Sassanian coins which he says have frequently been discovered in the Punjab topes. He fixes their probable date between the 3rd and 6th Centuries A. D., and concludes that the Sassanian dynasty prevailed in Upper India, and that Hinduism became mixed with the religion of Bactria.

After this, there can be little doubt of the remote antiquity of Hindoo coinage, so I shall speculate no further on the question, but come at once to more modern times wherein we know, that whatever new district we have annexed or acquired, and into whatever new country our people have pushed their way, scores of different kinds of currencies have been found in circulation, evidence of the fact that every petty native state ostentatiously maintained its own mint and peculiar coinage. Hence it is that such a vast variety of gold and silver coins have been current at one time or another in our territories in India, and indeed are still to some extent current.

From the time of Alexander's invasion to the Mahommedan supremacy, excepting that India represented a chess-board of independent Hindoo states, little is known of its political history. Many of the princes laid claim, we are told, to be Lord Paramount of the whole country, but without any solid title to the honor, and it is now nearly certain that as in Alexander's time, so for many centuries subsequent to him, these states, dotted over the length and breadth of India, led a feudatory and independent kind of existence.

After the breaking up of the empire of the Caliphs in the 9th century, and when several Arab conquests had taken place in the northern part of India, various dynasties we are assured sprang up,

* Vol. 5. p. 639.

till Sultan Mahommed declared his independence about A. D. 1,000 and established the first Mahommedan government at Ghazni, some 60 miles south of Cabul. A story is told of this prince that he promised a dirhem (Mr. Dow in his history of Hindostan says it was a mher) to the poet Ferdousi for every verse of a certain historical poem on Persia, and that although he meant a golden dirhem from covetousness he changed the payment into silver dirhems.

Dirhems and Dinars were the money of the Caliphs, and are thus described by D'Herbelot in his Bibliotheque Orientale.

" Les Mussulmans n'eurent point de dinars d'or marqués a " leur coin jusqu'en l'an 76 de l'Hegire (de J. C. 695.) Ce fut " Hegiage, lequel etablit la premiere monnoye sous le Khalifat " d'Abdalmalek. Auparavant toute la monnoye d'or etoit au coin " des Empereurs Grecs, et celle d'argent avoit son inscription " en charactêres Persiens. Les Khalifes Abbasides Haroun " Raschid, Almamom et Vathek firent battre de la monnoye a plus " haut titre que n'avoient fait les Ommiades."

The house of Ommiades ended in A. D. 750 and the Abbasides Caliphs succeeded.

" Dirhem et direm, le premier mot est Arabe et le second est " Persien. Un dirhem et demi pese un methcāl ou une drachme, " de sorte qu'il y'en a douze a l'once qui n'est que de huit drach- " mes, ou de huit gros. Le Direm pese aussi douze carats, et " se prend souvent pour un fort petite monnoye de cuivre. Ce " fut Hegiage Gouverneur de l' Iraque Arabique qui fit battre le " premier des Derahim d'argent avec l' inscription " Allah Samad" " Dieu est inmuable. Sous le Khalifat d'Abdalmalek, ils etoient, de " bas alloy : mais les Khalifs Abbasides les mittoient a plus haut " titre."

" Abul Fazl in his ' Ayeen Akberry,' a kind of supplement to his " Akbernameh, has given the following account of Dirhems and " Dinars. Dirhem was a silver coin originally of the shape of a date " stone, Caliph Omar changed it into a round form and some say " was the first to stamp an impression on it, others that Hejaj " in the time of Abdalmalek Meerwan, others that Mahan Ebn " Zobier was the first."

" Some say that Direms were of 10, 9, 6 or 5 miskals, others " of 20, 12, or 10 Keerats weight and that Omar formed a coin of " 14 Keerats being $\frac{1}{3}$ of the aggregate sum. In Omar's time " were current several kinds of Dirhems of 8 dangees."

" Fazel Khojendy says in former times there were two kinds of " Dirhems; 8 dangees and 6 dangees,

" 2 Hebbehs	=	1 Tessuj,
" 2 Tessuj	=	1 Keerat,
" 2 Keerats	=	1 Dang.

" Dinar is a gold coin weighing one miscal and is equal to $1\frac{3}{7}$ of a " Dirhem.

" Miscal is a weight used in weighing gold and is also the name " of a coin.

" 12 Zerrahs	=	1 Kitmeer,
" 6 Kitmeers	=	1 Nekeer,
" 6 Nekeers	=	1 Feteel,
" 6 Feteels	=	1 Ful,
" 12 Fuls	=	1 Mustard seed,
" 6 Mustard seeds	=	1 Barley corn,
" 2 Barley corns	=	1 Hebbeh,
" 2 Hebbehs	=	1 Tessuj,
" 4 Tessuj	=	1 Dang,
" 6 Dangs	=	1 Miscal,
by which a Miscal	=	96 Barley corns
a Dang	=	16 Do.
a Keerat	=	8 Do.

Upon the termination of the Ghazni dynasty in the 12th century, the house of Ghor, the slave Kings and the princes of Kilji, of Toglak, of the Seiads, and of Lodi followed in succession, and bring the history of India down to the house of Teimour and the conquests of Baber in 1526 who founded the empire of the Moguls.

In Elphinstone's account of Alla u Din's reign of the house of Khilji, at the beginning of the 14th century, mention is made, that Cafur one of the king's generals returning from an expedition, brought with him vast treasures to

1295—1316 A. D.

Delhi, to which in a foot note is added, "Ferishta* states that at "this time there was no silver coinage in the Carnatic: and Colo- "nel Briggs observes that the same was true to a certain extent "till very lately: the common coin was the pagoda and there was "a small coin called a gold fanam, as low in value as a sixpence."

Dow in his history, describing the distracted state of the country under Mahommed Toglak's rule, ascribes it to a number of reasons, and amongst others to "the king following the Chinese "custom of issuing paper upon the Emperor's credit for ready "money, and to his striking a copper coin which he "issued and made current by a decree at an imaginary value." He also adds, "that the merchants made their pay- "ments in copper to the poor manufacturers, at the same time that "they themselves received silver and gold for their export. There "was also much villainy practised at the mint: for a premium to those "who had the management of it, the merchants had their coin struck "considerably below the legal value. But the great source of the "misfortunes consequent upon the debasement of the coin, was the "known instability of Government. Afterwards the Emperor to "ease the minds of the people was obliged to call in the copper "currency."

1325—1351 A. D.

In Ferishta's history of the Deccan, mention is made in many places of money, as for instance, in his account of the Bhamenee dynasty founded by Zuffir Khan in 1347, he says—"Coins were "struck, impressed with his titles of Sultan Alla ad Dien Houssun "Raujah Bhamenee." Also at page 17, he adds, "the gold and "silver coins of the Bhamenee Sultans were of square form, and "different value, having on one side the creed of testimony,† and "the names of the four holy friends.‡ On the other was the sove- "reign title, and year of his reign. The Hindu bankers at the in- "stigation of the roies of Beejanuggur and Telingana melting all "which fell into their hands that the coins of the infidels might alone

* Who wrote a history of the Mogul Emperors and some other works at the latter end of the 16th Century.

† There is no God but God and Mahommed is his Prophet.

‡ Mahommed, Ali, Aboubekker and Omar.

" be current in the Deccan, the Sultan was enraged; and when they " persisted in the offence in spite of his remonstrances, he put all " the guilty to death, and restrained the business of exchange to " some Kutteries, descendants of Dhellians, who had migrated to " Deccan. After this, the Bhamenee coins alone were current in " the Mahommedan dominions, but since the cessation of that dy- " nasty, the coins of the Hindoo princes have been allowed also to " pass universally.

Again at page 23, describing the throne Firozeh of Sultan Mah-
1357 A. D. mood Bhamenee who reigned in 1357, he says, the jewellers valued it at a crore of *oons* which the Translator at p. 169 explains as being "those coins called pagodas by Euro- " peans, a lac of which make somewhat above £40,000," in which case the pagoda is estimated at more than $3\frac{1}{2}$ rupees, the common value assigned to it. Also at page 87, describing Firoze Shaw with his bride going to the camp of his father-in-law, he says, " The two princes rode on horseback together, between ranks of " beautiful boys and girls, who waved plates of gold
1407 A. D. " and silver flowers over their heads as they advanc- " ed, and then threw them to be gathered by the populace. Silver " flowers being small coins stamped with the figure of a flower " and still used in India to distribute in charity, and on occasions " thrown by the servants of the great among the populace."

At page 175, Cowries are mentioned as well as another money called Laares, " Mohammed Shaw having heard frequent reports of " the vast wealth of Rajah Jehaun, sent for his trea-
1481 A. D. " surer. The treasurer said, oh! Sultan, my Lord had " two treasuries one of which he called the Sultan's—in this there " are now 10,000 *laares* and 3,000 *oons*—the other he named the " treasury of the poor, in this there is a sealed bag containing " 3,000 laares. Whenever money come from his Jaghire, having " taken from the king's treasury the pay of his troops and stables, " he gave the remainder to the poor, not reserving a *cowrie* for his " own use.

In Baber's Memoirs written by himself, and translated by Mr.

1494. Leyden, frequent mention is also made of money. The memoirs commence with Baber becoming king of Fergâna, near Bokhâra and Samercand in Tartary.

At page 28, speaking of his uncle Sultan Mahomed Mirza, he says, " He was well versed in calculation, and not a single dirhem " or dinar of his revenues was expended without his knowledge." The Translator adds, " the former is now of the value of $5\frac{1}{2}$, and " the latter of about 9 shillings."

At page 61, mention is made of a " 1,000 *tumans* of silver," to which Mr. Leyden has appended this note, " It is extremely difficult " to fix the value of money in remote periods. The Tumân in " Dalla Valle's time (1617) was 10 Zecchins (Voyages vol. IV. p " 357). Mendelshoe soon after values the Zecchin at $8\frac{1}{2}$ or 9 " rupees; which would make the Tumân of that day worth 9 or " £10 sterling. In Chardin's time, the tumân was equal to 45 livres, " and Tavernier makes it equal to 46 livres, 1 denier and $\frac{1}{5}$, or ac- " cording to his English Translator at the then par of exchange of " 4*s*. 6*d*. for the French crown, £3 9*s*. and a fraction. The livre it " will be remembered like the tumân has been sinking in value. " Fryer (Travels p. 222) makes the Tumân £3 and a noble. " It was lately worth an English guinea and from incessant tam- " pering with the coin is now worth little more than 15 shillings. " As the decline has been constant, it was probably in Baber's time " worth more than the highest of these sums."

" The Shahrukki was a silver coin of the value of 10*d*. or 11*d*. " English, $2\frac{1}{2}$ shahrukkis being equal to a rupee in Akbar's time."

" The Tang or Tenki was a small silver coin of which in Men- " delshoe's time 14, 15 or 16 went to a pagoda. It was of the value " of about 5*d*. and was formerly more. It has now declined to " about a 1*d*. It seems to have been $\frac{1}{6}$ of a dirhem. The Dam " was an Indian copper coin, $\frac{1}{40}$ of a rupee."

At page 80, in his memoirs of the transactions of the year 1499, 1499 A. D. it is written " he did not give any one a single *dang*," probably the same as Tang. Also " not a *fils* from any other quarter reached him." Fils is explained to be a small copper coin.

At page 188, among the men who adorned the Court of Sultan Hussain Mirza, is included Bêhbud Beg "who did good service in "the Mirza's expeditions, and in reward of it, his name was in- "scribed on the Tangha and Sikka" that is, on the royal seal or stamp, and on the coin.

1519 A. D. At page 282, among the occurrences of 1519, it is mentioned that "the tribute of the inhabitants was fixed at 60 *mish-* "*kals* of gold," apparently the same as miscal which Abul Fazl makes equal to 96 barley corns. And further on, a diamond valued at ½ the expense of the world is said to have weighed 4 mishkals or 220 *ratis*.*

At page 290, of the events recorded of the year 1525, it is related
1525 A. D. that "the brothers of Nur and Beg arrived bringing "to the amount of 20,000 *shahrukkis*, in *ashreffis* "and Tanks" which the Translator estimates to be "about £1,000† "sterling." He also remarks that "nothing can afford a stronger "proof of the scarcity of specie in Kâbul than this appropriation "of so small a sum. The name of ashrefi is applied to the gold "mohur which is worth about a guinea and a half. It is applied "however to gold coins of various magnitude and value."

Throughout the latter part of the memoirs, in the mention of large sums, and in estimating the revenues of a district, Baber makes frequent use of the words *lacs* and *crores*, unaccompanied by any denomination of coin; Mr. Erskine‡ remarks upon this "that the "Emperors of Hindostan from a love of pomp and show, have al- "ways used large numbers in reckoning their revenues and in be- "stowing presents. Their revenue accounts were kept in *dams* of "which 40 go to a rupee. Hence their lacs and crores sink into "very small compass when reduced to English money."

* Mr. Dow in his history of Hindostan makes the miskal equal to 39 rutteys (which I suppose is the same as *ratis*) and a ruttey equal to ¾ of a carat, a carat being the same as keerat mentioned by Abul Fazl, makes the rutty equal to 7 barley corns.

† This makes the value of a Shahrukki, a shilling instead of 10*d*. or 11*d*. as he said before.

‡ Who with Mr. Leyden translated Baber's memoirs.

In the Ayeen Akbeery by Abul Fazl, translated by Mr. Gladwin, very detailed accounts are to be found of the state of the mints and the coinage in Akbar's reign.

1556—1605 A. D.

That the officers of the Mint were

" 1. A Derogah (or superintendent.)

" 2. Shroff (assay master.)

" In Persia are 10 degrees of fineness called Dehees, in Hindostan 12 degrees " called Barah Bannees. Formerly the old 'hun' a gold coin current in the " Deccan was 10 bannees, Akbar made it 8$\frac{3}{4}$.

" 3. Aumeen—a disinterested party to see that nobody acts " dishonestly.

" 4. Mushreff—to write the waste book.

" 5. Merchant—to buy gold and silver.

" 6. Treasurer—to watch over the stock of profit.

" 7. Weighman.

" 8. Melter of metal before it is refined.

" 9. Plate-maker.

" 10. Melter of refined metal.

" 11. Zerrab—who cuts metal into size of coin.

" 12. Seal engraver.

" 13. Sickchy—places the round piece of metal between two " dies, and by strength of hammer both sides are stamped.

" 14. Subbak—makes refined silver into ingots.

" 15. Koorskoob—having heated refined silver, hammers till " it has lost all smell of lead.

" 16. Chashneegeer—assays the refined silver.

" 17 and 18. Employed in recovering precious metals from drosses.

" 19. Pykar—brings drosses and litharge from city goldsmiths " to be melted.

" 20. Neecheweewala—brings old silver coins to be melted.

" 21. Khakshu—rents the sweepings of the mint from Go- " vernment at 12$\frac{1}{2}$ rupees per mensem.

About the 36th year of his reign, Akbar turned his attention to the coinage, restored the standard, and directed that all species of coins though they might be received by the Collectors of his re-

venue, were only to be taken for as much as was their value by the new standard.

The names, values, forms, and impressions of the different coins as given by Abul Fazl, I have subjoined in a Tabular form.

GOLD COINS.

Names of Coins.	Weight. Tolahs.	Mashahs.	Ratees.	Value.	Form.
Sehenseh	101	9	7	12,000 Rupees.	Circular.
Do.	91	8	0	900 do.	do.

Rehess....half of both of the above and made square.

Atemah....a quarter of the Sehenseh.

Binset.....a fifth of the Sehenseh, there are also Binsets of $\frac{1}{8}$, $\frac{1}{10}$, $\frac{1}{20}$, and $\frac{1}{25}$ parts of a Sehenseh.

Jugul......a fiftieth of the Sehenseh.

Names of Coins.	Tolahs.	Mashahs.	Ratees.	Value.	Form.
Chargoshey .. Aftaby........	1	2	$4\frac{3}{4}$	12 Rupees.	Round.
Ilahee..	0	12	$13\frac{1}{4}$	12 do.	do.
Laal Jilaly.....	0	12	$13\frac{1}{4}$	12 do.	Square.
Adel Gootkeh..	0	11	0	9 do.	Round.
Mohur ...... Mehraby.....	0	11	0	9 do.	do.

Geerd......... $\frac{1}{2}$ of Ilahee.
Dehn.......... $\frac{1}{2}$ of Laal Jilaly.
Seleemy........ $\frac{1}{2}$ of Adel Gootkeh.
Reby.......... $\frac{1}{4}$ of Aftaby.
Mun........... $\frac{1}{4}$ of Jilaly.
Nisfy Seleemy.. $\frac{1}{5}$ of Adel Gootkeh.
Punj........... $\frac{1}{5}$ of Ilahee.
Pandow........ $\frac{1}{5}$ of Laal Jilaly.
Sumny......... $\frac{1}{8}$ of Ilahee.
Kala.......... $\frac{1}{6}$ of Ilahee.
Zerrah......... $\frac{1}{32}$ of Ilahee.

SILVER COINS.

Rupeeah weighs 11¼ mashahs---first introduced by Sheer Khan, and by Akbar made more pure. Market price is 40 dams.

Jilaleh---same impression and weight as rupeeah.

1¼ Sooky	=	1 Kala.
1⅗ Kala	=	1 De-fa.
1¼ De-fa	=	1 Ashet.
1⅗ Ashet	=	1 Pandow.
1¼ Pandow	=	1 Chern.
2 Cherns	=	1 Durb.
2 Durbs	=	1 Jilaleh.

There are also similar subdivisions of a rupee of a round form.

COPPER COINS.

Dam is a copper coin, in weight 5 tanks or 1 tolah 8 mashahs 7 ruttees, in value $\frac{1}{40}$ of a rupee, formerly called pysah and also Behlooly; accomptants suppose the dam to be divided into 25 parts, each of which they call a cheetel, and use them in calculations.

2 Dumrees	=	1 Powlah.
2 Powlahs	=	1 Adheleh.
2 Adhelehs	=	1 Dam.

From this time, Akbar's coinage may be said to have formed the bulk and basis of the currency of the country, although numerous independent states exercised the privilege of coining and fabricating pieces of a very different stamp, weight and fineness. Rupees, mohurs and pagodas form the prevailing denomination to be met with.

In the "Memoirs of the Mogul empire" by Eradut Khan Wazeh translated by the same Mr. Scott, from whose translation of Ferishta's History of the Deccan I have before quoted, the author describing his interview with the emperor Aurungzebe about A. D. 1700, says, (p. 3,) "when I returned to his "presence, his majesty gave me his blessing, 200 mohurs and one "coin weighing 100 mohurs," to which this note is appended, "Golden coins of this and greater weight were often given as

1700 A. D.

" marks of favor—silver coin, of several hundred rupees value " were also in use; and there is one of them now in the British " Museum, of which the ingenious Mr. Richardson has given a " very full description in his very learned work, the 'Persian and " Arabic Dictionary.' "

Elphinstone* in his history, alludes very cursorily to the ancient coinage of India and merely tells us, " that the first princes used " dinars and dirhems like the Caliphs, these were succeeded by " tankhas divided into dams and jitals—Shir Shah† changed the " name of tankha to that of rupeia, or rupee, which was adopted " by Akbar, and the latter prince fixed the weight and relative va-

1761 A. D. lue of money on a scale which remained unaltered " till the dissolution of the Mogul empire, (1761 A. " D.) and is the basis of that now in use." In a note he adds, " the " Dinar under the Caliphs was about equal to 10*s.* 8*d.* In Ibn " Batuta's‡ time a western dinar was to an eastern dinar as 4 to 1 " and an eastern dinar $\frac{1}{10}$ of a tankha, which even supposing a " tankha of that day to be equal to a rupee of Akbar, would be " only $2\frac{1}{4}$*d.* The tankha is said by Ferishta to have been in Ala u " Dins time (1295 A. D.) equal to 50 jitals, and in Mohammed " Toglak's time (1325 A. D.) it was so debased as to be worth no " more than 16 peisas."

" The rupee§ of Akbar contained 174.5 grains of pure silver " and was divided into 40 dams or peisas (of $191\frac{1}{2}$ grs. of copper " each). The dam was divided into 25 jitals (probably a nominal " coin). Queen Elizabeth's shilling contained 88.8 grs. of pure " silver---Akbar's rupee therefore was worth 1*s.* $11\frac{1}{2}$*d.* of English " money of his time."

Having thus traced the various denominations of coins from very early times down to a more modern date with such explanations of their values and kinds annexed as are afforded by cotem-

* Page 429.

† Lived 1540 A. D.—947 A. H.

‡ Who wrote nearly 2 centuries before Baber, that is, about A. D. 1300.

§ Weighed 187.5.

porary authors, I will conclude with some account of our present coinage, and compare it with others that have been current within the last century in British India.

From a revised Assay Table, lately published by the Bombay Government, of coins current in the territories under that Presidency, or imported there as bullion, it is shown what a marvellous variety of sorts each district exhibits. It should be remembered, these are all coins of quite a modern stamp, with one or two exceptions, probably none of them being much more than a 100 years old.

The Table contains 27 varieties of gold coins current in, or imported from the Madras Presidency. Of these, the average is 80 per cent touch, that is 20 alloy to 80 gold, while the English sovereign is 91·666 touch.

Among them the Gharava Tharokee Pagoda formerly current in the Southern Mahratta country, gives the finest touch being 85.25. While the Sultana and Canteroy Fanams show most alloy, being only 58 and 59 touch respectively.

The same Assay Table gives 22 varieties of Rupees from Guzerat with an average touch of 87.

The highest being the Ahmedabad Hallee Rupee, 98.05.

The lowest the Chittoree Rupee, 74.52.

The fineness of the new Company's Rupee current through British India is 91.666. And the English shilling, 92.5.

Twenty varieties are given of the Deccan coinage, with an average touch of 88.

The highest being the Berhanpoor Rupee, 94.75 ; coined by Scindia in Khandeish.

The lowest, the Komptee Old Rupee, 63 ; struck at Pannallee by the Rajah of Kolapore.

Eighteen varieties of the S. Mahratta coinage with an average touch of 86.

The highest being the Phoolsheree Rupee, 95.60 ; a species of Ankoosee : coined at Phoolsher.

The lowest the Nilkunkee Rupee, 54.

Twenty-nine varieties of the Hyderabad Assigned* Districts with an average touch of 80.

The highest being the Chandore Rupee, 92.

The lowest the New Narrinpett Rupee, 74.86.

Twenty-six varieties from Scinde with an average touch of 86.

The highest being the Tuttaee Old Rupee, 98 23, current at Shabunder, Dhurraza, Succara and Kekrola.

The lowest the Hydrabadee Rupee, 69.60.

Fourteen from the Punjaub, with an average touch of 88.

The highest being the Sha Jehan Rupee, 97.76.

The lowest the Goondashye Rupee, 75.52.

These examples will serve to exhibit the state of the currency before the establishment of Mints by the E. I. Company. That these were all the varieties of coins, and that there were not legions of others up and down India, I must not for a moment be supposed to put forward. Only the other day Mr. Seton Carr in his speech to the Court of Proprietors upon the policy of granting Lord Dalhousie a pension, mentioned that the Company's Rupee had supplanted some 60 different kinds of currency in the Punjaub alone, and I imagine the varieties there are not more numerous than in other parts of India.

* In 1852, the Nizam's Government sent down a number of Uncurrent Coins weighing 9,51,166 Tolas 8 A. 0 P. to be assayed and valued at Madras, in order that their net outturn in Company's Rupees might be taken in payment of the Nizam's debt to the British Government. Subjoined is the result of the operation given by Major J. T. Smith, the Mint Master at that time, showing the net Outturn to be 8,14,203 Rs. 14 A. 7 P., exclusive of Seignorage and Refinage.

Gross weight.		As per Assay Master's outturn Reports, dated 3rd September and 30th October 1832.		
Before Melting.	After Melting.	Standard Weight.	Outturn Value.	Net Outturn Value.
Tolas A. P.	Tolas A. P.	Rs. A. P.	Rs. A. P.	
9,51,166 8 0	9,49,899 8 0	8,39,563 10 $\frac{3}{8}$	8,39,563 9 0	8,14,203 14 7

In Col. Smith's Report also, upon the various points of enquiry regarding the Madras Mint, suggested by the Government of India, the Hydrabad Currency is alluded to in these words, (para. 42) "An extensive Coinage will probably be "required to rectify *the indescribable confusion* of the Hydrabad Currency. Its "value is, I believe, estimated at from 2 to 3 Crores, which with a due proportion "of small Silver and Copper coins, would require a coinage of 17 or 18 crores of "pieces."

With regard to the coins which have just been enumerated, it is right to draw attention to the high standard of value the majority of them reach. It almost leads one to suppose that native Princes never debased their coinage, as the Romans did in the 1st Punic war, when they reduced the As from 12 oz. to 2, and as Henry VIII. and some of our Kings have done, and as James did in Ireland in 1698 after the siege of Londonderry, to serve their own or some political convenience, were it not that such a conclusion is opposed to all we know of the origin and lives of many of them—who being often mere adventurers, and succeeding to the musnud by some happy stroke of luck or desperate villainy, were not likely to neglect the mint, so powerful an engine to wipe off a debt or replenish (for the moment) an empty treasury. Indeed, we may feel certain that tampering with the fineness of the metal was a very common practice with them, for we know it was customary with native Financiers in Bengal to demand "a Sherusteh "Butta or per centage on the difference between the coin in which "the lands were universally assessed and the coins in which the "cultivators paid their taxes," and no doubt they made it a fruitful source of income.

Akbar's coinage however is admitted by all hands to have been the true and ancient standard. Jervis speaking of it in his Indian Metrology, (p. 63) says, "the coins of Bengal were origi-"nally the same as those of Surat, as restored and established by "the wise and virtuous Akbar. The true tola weight and the weight "of the rupee was then fixed at 12 massas or 187.5 grains."

A curious account of Akbar's treasures in coined money and jewels is given in the "New History of the East Indies," translated from Abbe de Guzon, (page 263. vol. i.) "Achobar for so that "prince was called caused a certain species of money to be coined "of the value of 25, 50 and 100 toles which were worth 2,012½, "4,025, 8,050 crowns, each piece, amounting to the sum of "6,970,000 massas which make 97,580,000 roupees or 48,790,000 "crowns, money of France. He had also besides a 100,000,000 "of roupees or 50,000,000 of crowns, in a certain species of money "called after his name, roupees of Achobar. And 250,000,000 of

" another species of money called peisas or pechas, 30 of which " make a roupee.

" The peisas or pechas are a small piece of copper not quite 2 " lairds French money in value.

" The mamoudy is their smallest piece of silver, it is valued at " 10½ sols ; 26 pechas = 1 mamoudy ; a roupee of silver is valu- " ed at 30 French sols.

" The roupee of gold is only known among the great lords, and " is worth 14 silver roupees or 21 livres. The thiel of silver makes " 11, 12 or 13 roupees current money. The massas is another " piece, of which 11½ make a thiel of silver ; and 10 of these make " a thiel gold.

" 100,000 roupees	=	a lek.
" 100,000 leks	=	a couron.
" 100,000 courons	=	padan.
" 100,000 padans	=	nil.

I do not engage to understand Mon. Guzon's computation, in one place he says, 30 *peisas* make a *roupee* and afterwards that 30 sols make a *roupee* and that a *peisa* equals 2 lairds (or ½ a sol), but I give the extract as a curiosity. The sol, the livre, the laird, the denier and the pistole formed the ancient money of France which ceased to be current in 1834.

To go back to Jervis again, who says Akbar's rupee was divided into 12 massas, each massa being 15.625 grs. troy, we find, " In " the reign of Shah Jehan the coinage was reduced to 11½ massas, " and this multiplied by 15.625 shows the origin of the deteriorat- " ed coins of later years, and equals 179.6875 grs. troy, which " standard with very trifling modifications has continued at a stay " ever since, though it is remarkable through the profound ignor- " ance of our own governments and countrymen on the subject or " probably their apathetic indifference to such calculations and to " the great financial questions in connection with the character, " dignity and stability of the state, this standard has been suppos- " ed to be the full weight of 12 massas or 1 tola, and now ulti- " mately fixed as the unit of the monetary system throughout " British India."

When we first came to India, attracted by the inviting reports of Drake and Cavendish, and were permitted to establish here and there a factory, originally subordinate to Surat, but afterwards to Madras, Bombay and Bengal---constantly at war to-day with the Mahrattas, to-morrow with the Moguls, and the next with the Dutch, Portuguese or other European rivals---our hold upon India, even up to the close of the 17th century, was of far too precarious and insecure a nature to admit of our finding, at the present day, many traces significant of our early occupation of the country ; nevertheless our factories and stations rapidly continued to extend with a growing charge in their accounts to " Civil and Military expenses," and eventually resulted in the foundation of a British empire in the East, the envy of the present age. In this preliminary state, things continued with variable fortune till 1746, when our political horizon looked gloomy in India, and Madras was taken by the French, but restored by the peace of Aix la Chapelle in 1748. Subsequent to this, occurred those memorable struggles between our countrymen under Clive and the French under Dupleix, ending after a long conflict in their overthrow, and in the extinction of the Mogul empire and the eventual succession of Company Durbar. In 1771, the East India Company, we are told, "stood forth publicly in the character of Dewan."

It is not always an easy matter to get information of many things connected with our first government of India—and the coinage of money is among the number.

Cæsar Mureau's " E. I. Company's Records" exhibit in chronological order the Commercial and Political history of the Company from 1600 to 1823, and is a very comprehensive account in a succinct and readable form ; but he alludes to mint matters only once, and that merely to say that in 1677 permission was granted the Company to coin money.

The earliest notice of a mint, I can anywhere trace, is in Kayes' History, (p. 68,) where speaking of various administrative schemes proposed by the Court in 1669-70, he says, "They recommended also the establishment of a Mint."

1669 A. D.

Accordingly in the charter granted by Charles II. to the E. I.
1677 A. D. Company in 1677, besides having their old privileges confirmed to them, authority was granted them to coin money (not resembling British money) at Bombay and other places in India, with respect to which Mr. Kayes says, (p. 71)—" The establishment of a mint had long before been re-" commended to the Company by their servants abroad; and it " had been much considered and discussed but had never before " taken practical shape. It was now however actually to pass in-" to a fact by the express permission of the crown. The Company " regarded it simply as an instrument of trade but their servants " five and twenty years before had been looking at the matter of a " Tankshall* in the Deccan in connexion with the question of war.

" The Factors at Rajapore, recommending the Company to coin " money, wrote in 1659 " For your worships may please to know " that all these artificial mines of money which were made in time " of peace are now exhausted through a civil war—will it not be " necessary to have a Tankshall in the Deccan and a coin that will " be current to carry on a trade here, as large as you please during " your war with India and which will continue no longer than you " please?—Then judge if you would not make the Tankshall " cry as mournful to the king of India's ears as the liver, the " fountain of the blood, should complain in a natural body, and " then what conditions you may bring him to is easy to foretell."

Many years would naturally elapse before the Company's coinage took an important part in the general circulating power of the country. Each district wedded to its own currency would reasonably be jealous of a foreign coin, and resist its introduction at any rate at first. It was probably far into the 18th century before the Company's coinage took its place among the other currencies of the country and performed a material part of the duty of circulation.

Mr. Dillon in his " East Indies" speaking of the natives in
1698 A. D. Malabar alludes to the currency of that part of the world in 1698, " To every one of these natives you

* From two Sanscrit words signifying *a coin* and *a hall.*

" pay 8 tares per diem which amounts to ½ a fanam. The fanam is " a small piece of gold worth 16 tares, and the tare is a small sil- " ver coin worth about a ½*d.* Each native has not above 4 tares a " day when he keeps guard in a house, but when he travels he has " double pay."

In an old Fort St. George Journal for 1716 is an entry for the month of May, " Rupees Madrass Dr. to Edward " Harrison, Esq., Mint Master, Pagodas 238-32, for " 836½ Rupees received of him account coinage at 350 Rups. per " 100 Pag." And in the June Journal, " Rupees Madrass Dr. to " Edward Harrison, Esq., Mint Master, Pag. 105-9-0, for 268-5-0 " dd. out of the Mint into the Warehouse account coinage for the " month of May at 350 Rups. per 100 Pag.," and so on for other months.

1716 A. D.

Pagodas and Fanams were the old money of account at Madras, and were reckoned in this wise.

10 Cash made a Dudy.

8 Dudies made a Fanam.

45 Fanams made a Pagoda.

Lullier has given an account of Pondicherry in 1722, and alluded to the currency in these words. - " The Company " (French) as Sovereign of Pondicherry and its de- " pendencies causes money to be coined there in the name of the " king. Cowries are not taken in payment, which however are " current in the country, although no more than little shells 20 of " which are worth a liard. They also use caches (cash) a small " piece of copper worth a denier: the largest pieces of silver are " valued at 4 sols; and their coins called Pagodas ½ a pistole."

1722 A. D.

Stavorinus in his account of his voyage to the East mentions gold and silver Rupees as current in Bengal and throughout the whole extent of Hindostan, stamped with Persian letters instead of any portrait or arms. " When the " Rupees first come from the mint they are called Sicca Rupees " of the first year, and they decrease every year in value, and at " the end of nine years are taken at the same rate as Arcot Rupees. " Those coined at Moorshebad are the current coin in which the

1768—1771 A. D.

" trade of the Company is carried on. It is the money of account " according to which the value of the other Rupees is calculated. " The Arcot Rupees are coined by the English at Arcot and by the " French at Pondicherry. The gold Rupee called Mohur is worth " 15 silver Sicca Rupees."

At page 475 of vol. ii. of his voyages he describes the Mint at Surat. " The mint where the silver is imported and coined into " Rupees, by having the impression of the Emperor's name and " the year of his reign stamped upon them, is a large pile sur- " rounded by a high wall—along the wall are sheds under which " the workmen sit: on the right hand is an elevated apartment for " the overseers and inspectors when any work is doing; opposite " to it a square place is walled off where the silver and copper are " melted and cast in moulds into bars or ingots. The metal is " weighed to the workmen who cut it into pieces of the exact " weight which the coin to be struck requires, every one having a " pair of scales at hand for that purpose in which every piece is se- " parately weighed. These workmen beat it round and flat, though " one piece sometimes falls thicker than another to which exact " attention is not paid. It then goes to the coiners who were then " about 30 in number, each of whom has an assistant, who puts " the prepared piece of copper or silver upon the lower die, while " the other places the upper one which he holds in his left hand " upon them, and stamps the impression upon them with a forcible " blow of a hammer."

Schomberg describes the Mint of the king of Oude much in the same terms; his account is somewhat more modern, and it appears the Oude Mint paid more attention to the beauty of the coin and the accuracy of workmanship, the description does not otherwise differ much from that given of the Surat Mint.

Mr. Holt Mackenzie in his evidence before the Select Committee in 1832 says, " the Sicca Rupee has been a legal tender in Calcutta " ever since we acquired the country—the present Sicca Rupee bears " the date of the 19th year of the last King—There were 3 Rupees, " the current Rupee, the Sonat Rupee, and the Sicca Rupee— " But previously to A. D. 1773, the Rupees were distinguished by

" the years in which they were coined; that is to say the impres-
" sion bore that they were struck in such a year of the reigning
1773 A. D. " King of Delhi; and after circulating 4 or 5 years
" they suffered a depreciation whether they had lost
" weight or not, being reckoned Sonat Rupees, that is, Rupees " of
" years." These with several other coins continued to circulate at
" different rates of discount, and accounts were kept in a nominal
" coin called the current Rupee, which was probably taken at the
" rate of 116 to the 100 Sicca Rupees to represent the average of
" the currency actually in circulation. The first step to reform,
" was a resolution that all Rupees coined in future should bear
" the impression of the 19th year* of the reign of Shah Allum,
" and so put an end to the arbitrary distinction previously made to
1792—3 A. D. " the coinage of different years; and in 1792—3 A. D.
" the Sicca Rupee was by the rules contained in Reg.
" 35 of the Bengal code rendered the only legal silver currency
" for the provinces of Bengal, Bahar and Orissa—The Sonat Rupee
" is still used in the military accounts and is considered equivalent
" to the Ferruckabad, Madras and Bombay Rupees. Since
" 1793 all other Rupees but the Sicca Rupees have been receiv-
" ed as bullion. The Sicca Rupees used to be receivable as of
" full weight, if the deficiency did not exceed 6 Annas ($\frac{6}{16}$) in
" 100 Rupees. Since 1818 the limit has been extended, a defici-
" ency of 2 pice ($\frac{2}{192}$) or about 2 grains being allowed in each
" coin. In the remoter districts and in the dealings of the poorer
" classes, different rupees appear still to be in circulation, but the
" mass of the currency is the Calcutta Sicca Rupee. In general
" the state of the currency out of the Company's territory is very
" irregular, each Sovereignty has its own Rupees and they vary
" very considerably."

Further evidence was also given before the same Committee,
1809 A. D. that prior to 1809 there were *four* Mints in the Bengal territories, one at Calcutta, one at Benares, one at Ferruckabad, and one at Delhi; and there were *three* currencies, the Calcutta Sicca, the Benares, and the Ferruckabad Rupee, the last

* About 1773 A. D.

called also Quenow Rupee, because intended to be equivalent to that of the Oude Government, and struck both at Ferruckabad and Delhi, but the Delhi Mint was never employed to any great extent. For a long time back, the Calcutta Sicca Rupee had circulated in Bengal, Behar, and Orissa—the Benares Rupee was confined to the province of Benares, and the Ferruckabad Rupee to all ceded and conquered districts, except Cuttack and the acquisitions east of Bengal, into which the Calcutta Rupee had been introduced. It was also stated that the standard of the Calcutta Sicca Rupee and Ferruckabad Rupees was the same, being $\frac{1}{12}$ alloy —the former weighing 192 grains with 176 grains pure silver, the latter weighing 180 grains with 165 grains pure silver, omitting fractions—and that at Madras and Bombay the rupee was similar to the Ferruckabad—and that there was a mint at Saugor established for the temporary purpose of converting local currencies into Ferruckabad Rupees. It was likewise stated that a copper coin passes through the Bengal territories at the rate of 64 to a Rupee, but is legal tender only for the fractional parts of that coin—and that because the market value of gold relatively to silver was greater than the mint value, therefore gold had ceased to circulate. Also that the Bengal gold mohur weighs 204·710 grains of which 187.651 is fine gold—and that the Madras gold Rupee is of the same weight and standard as the silver, viz. 180 grains—and that at both Presidencies the relative value of gold to silver is 15 to 1—and that there were *three* mints at Bombay, one at the Presidency, one at Trivat and one at Broach, and that Madras had one mint.

1818 A. D. In 1818, the Bengal Government added to the weight of the Rupee, leaving the quantity of silver the same and increasing the weight by alloy, the reason given was that the Rupee being much purer than other coins, and more especially than the Spanish Dollar of which the import into Calcutta was large, a considerable expense was incurred in refining, and some delay occasioned.

In 1819, the currency was changed in Madras from Pagodas to Rupees, in which former coin all accounts had previously been kept, and the Rupee was rated in the accounts rendered to Parlia-

ment at 2*s.* 3 $\frac{408}{1000}$*d.*, though at the mint price of silver in England it should only have been 1*s.* 11 $\frac{40}{1000}$*d.*

1835 A. D.

In 1835, the East India Company's coinage underwent its final adjustment to the state that it remains in at the present day. It was ordained that the undermentioned coins only should be coined at the Mints within the territories of the East India Company.

The Co.'s Rupee weighing 180 grains.			$\frac{11}{12}$ standard, or 165 grains pure silver and 15 grains alloy.
The	$\frac{1}{2}$	do.	
& the	$\frac{1}{4}$	do.	

Impression on one side, the head and name of the Sovereign of Great Britain, on the reverse, the name of the coin in English and Persian, and of the East India Company.

The Company's Rupee, $\frac{1}{2}$ Rupee and double Rupee to be legal tender, if not deficient more than 2 per cent. in weight, and if not clipped or filed or defaced otherwise than by use.

The Company's Rupee to be equivalent to the Bombay, Madras, Ferruckabad, and Sonat Rupees, and to $\frac{15}{16}$ of Calcutta Sicca Rupee; Company's $\frac{1}{4}$ Rupee to be legal tender only in payment of the fraction of a Rupee.

The undermentioned gold coins only to be coined at the mints: A gold mohur or 15 Rupee piece, 180 grains weight and $\frac{11}{12}$ fine.

A	$\frac{1}{3}$	do.	or 5	do.	do.
A	$\frac{2}{3}$	do.	or 10	do.	do.
A double		do.	or 30	do.	do.

Gold coin not to be legal tender.

By a proclamation issued in 1841 gold was allowed to be received at the public treasuries in payment of taxes, and was so received very frequently till 1852, when in consequence of the discovery of gold in Australia the proclamation was cancelled, and gold is now only received into treasuries as deposits for security.

To compare the Company's Rupee with an English Shilling.

The Co.'s Rupee is 180 grs. in weight of which 165 are pure silver.

that is, 440 grs. out of 480 grs. (the oz.) are pure silver.
or 220 dwts. out of 240 dwts. (the lb.) are do.
that is, the Co.'s Rupee is $\frac{11}{12}$ fine or ·916 touch.

The English Shilling is 87 $\frac{3}{11}$ grs. in weight of which 80 $\frac{8}{11}$ are pure silver.
that is, 444 grs. out of 480 grs. (the oz.) are do.
or 222 dwts. out of 240 dwts. (the lb.) are do.
that is, it is $\frac{37}{40}$ fine or ·925 touch.

English silver which is $\frac{37}{40}$ fine is called standard silver.

The Company's Rupee, it will be observed, is Worse .009, that is, a pound of English standard silver contains 2 dwts. more pure silver than a pound of Company's Rupees.

In England, from 1600 A. D. down to 1816, a pound of standard silver was coined into 62 shillings—in 1816 it was ordered to be coined into 66 shillings, 4 shillings being retained by Government as a seignorage amounting to 6 $\frac{17}{31}$ per cent. By this means, a fictitious value is given to the silver coinage, and the pieces pass current for more than their real value, and thereby having no value in other countries equal to their value at home are neither melted nor exported. Though in England an oz. of standard silver is coined into 5 Shillings and $\frac{6}{12}$ of a Shilling over, ($\frac{4}{12}$ of which are retained as seignorage) yet silver coins are always rated at the assumed price of 60*d.* per oz. per British standard.

An oz. of silver B. standard = 60*d.*
therefore 1 grain = ·125 of a penny.

A Company's Rupee contains 178·37 grains B. standard
therefore Co.'s Rupee = 1*s.* 10·29625*d.* (Par of exchange.)

Sicca Rupee weighs 191·916 grains of which
175·921 are pure silver,
or 176 B. standard silver.

That is 439·995 out of 480 grs. (the oz.) are pure silver,
or 219·997 out of 240 dwts. (the lb.) are do.

That is, it is $\frac{219977}{240000}$ fine, or ·9165 touch,
and 1*s.* 11·78*d.* is its Par of Exchange.

For easier comparison I annex a tablular Statement of some of the principal Silver Coins at present current in different parts of the world.

Names of Coins.	Gross weight.	Quantity of pure silver.	Quantity of British Standard silver.	Number of grains out of 480 (the oz.) that are pure.	Number of Dwts. out of 240 (the lb.) that are pure.	Touch.	Par value in English money.		Par value in Company Rupees.
	Grains.				Dwts.		s.	d.	Co. Rups.
French 5 Franc piece..	$385\frac{3}{4}$	347·17	375·32	431·9	215·95	·8997	3	10·915	2·104
Dutch Florin..........	166	148·01	160·01	427·98	213·99	·89162	1	8	·897
United States Dollar....	416	370·93	401·01	427·996	213·998	·89165	4	2·12	2·247
Russian Silver Rouble..	320	277·33	299·82	416	208	·866	3	1·47	1·680
Company's Rupee......	180	165	178·37	440	220	·916	1	10·29625	—
Sicca Rupee..........	191·916	175·921	176	439·995	219·997	·9165	1	11·78	1·625
English Shilling........	$87\frac{3}{11}$	$80\frac{8}{11}$	—	444	222	·925	—	—	·538

III. *Entomological Papers, being descriptions of new Ceylon Coleoptera with such observations on their habits, etc., as appear in any way interesting. By* JOHN NIETNER, *Colombo, Ceylon.*

No. I.

[Introductory Note on the publication of new species under disadvantages such as describing entomologists necessarily labor under in countries remote from the European centres of science.]

I little doubt that the following descriptions of new Coleoptera will meet with anything but approbation from the entomological world at home. As, however, in spite of this anticipation of an ungracious reception, I shall not be deterred from my purpose of publishing such descriptions hereafter, I may as well try to vindicate this measure, by setting forth the reasons which induce me to consider the difficulties which beset the path of the entomological author in this country, as not insurmountable.

The objections raised against me will be these: that considering the state in which entomological literature still is, that is to say, considering that it has not, generally speaking, been condensed into a certain limited and obtainable number of volumes, as is the case in the higher branches of Zoology and Botany, that on the contrary the bulk of it consists of fragments which float without order in the misty and unfathomable ocean of scientific journals—it is next to impossible that an individual entomologist abroad should surround himself with this shapeless mass of learning, and keep himself by this or other means so well informed of the details of the actual progress of the science, as not to be exposed to mistakes of one kind or another but more especially to the multiplication of synonyms, in attempting to work independently. It will further be urged against me, that not having the facilities and the wholesome check which arise from the diligent use of extensive and well named collections, not even having the gratification of a brother entomologist's views and opinions on doubtful cases, it will be impossible even to determine whether an insect be new or not; and from these reasons it will be inferred, that entomologists abroad should

confine themselves to collecting and observing the habits of the objects of their attention, but that they should never go to print with matters, on which it is impossible for the ablest among them to be quite competent to deal with. These arguments are unfortunately too true, but still I think they admit of being mitigated sufficiently to come to final conclusions less disheartening than the above.

First of all, every entomologist gives preference to a certain order of insects—say *Coleoptera*—and in this, even in almost all cases, to one or two particular families. In studying for the publication of new species under the disadvantages just mentioned, he will confine himself to this order or perhaps family. Now, although as objected above, the information existing on this particular branch is for the most part fragmentary, still there are certain families on which it has received a tangible shape, through condensation by able hands: Burmeister's *Lamellicornes*, Dejean's *Carabidæ*, Erichson's *Staphylinidæ*, Schoenherr's *Curculionidæ*, Boheman's *Cassidæ*, Westwood's *Paussidæ*, etc., as well as the latter author's general work on the families, and Lacordaire's on the *Genera Coleopterorum*, diligently consulted, go as guides a long way, and should, although some of them have by the rapid progress of the science become rather antiquated, guard against a number of mistakes of a systematic nature. As to whether a beetle be new or not, I admit that in forming an opinion on this question the entomologist situated as above, will have quite as much to be guided by a certain tact (not clearly definable but understood by scientific men) as by anything else, and I am forced to concede that under almost any circumstances, it is totally impossible to arrive at an *indisputable certainty* either the one way or the other. This, however, by no means excludes the possibility of his forming an opinion with so much precision, as to enable him to pronounce in the matter with a very *high degree of confidence and all probability* in his favor. In attempting to come to a decision on this difficult point, he will receive a first superficial idea from careful reflection on certain accidental circumstances, such as size, scarcity, or other peculiarities of the insect in question. This idea, which ever way it may incline, will then either gain or lose strength by diligent reference to his library, until at length with a certain amount of

tact and judgment he will arrive at a result, which under such circumstances must carry much weight with it. I shall illustrate this case by an example: If for instance after collecting for five years in Ceylon generally, and in the Colombo District more especially, I find at the latter place an insect—say the *Chlænius* 5-*maculatus* described below for the first time, am I not entitled to consider it as very scarce? If on consulting my library I discover nothing which can possibly refer to it (finding that not a single *Chlænius* is marked as occurring in Ceylon), are not the chances greatly in favor of its being an undescribed species? If again, I collect beetles as small and inconspicuous as the *Trichopteryx* described below, and consider at the same time that, although they are in certain localities of common occurrence, no professional Coleopterologist has ever collected before me in this Island; if, moreover, my library offers nothing that could possibly refer to them individually (there being hardly an Asiatic species mentioned), am I under these circumstances not justified in considering them as undescribed? Decidedly I am. Circumstances like these would indeed be altogether conclusive, if there was not a chance of the beetle occurring in some neighbouring country, and it having thence found its way into the normal collections of Europe. The possibility of such being the case, of course enhances the difficulties of the case very materially, but I do not see why they should not, to a certain degree, be overcome by the same or similar means as those cited for overcoming them in one particular country.

I think I have said enough to show, that the disadvantages encountered by the entomologist here, or in other places similarly situated, in *conscientiously* attempting to publish new species may (his principal assistance being perseverance, a good library and tact—entomological instinct I am almost tempted to call it)—be overcome, I am far from saying *entirely*—but so far as to expose him from *want* of resources in the execution of his plan, *to no more mistakes* than are incident to entomologists under more favourable circumstances, from *neglecting them.* But I am not satisfied with obtaining the simple grant of permission to describe on the spot a part of what he collects—I claim more for the entomologist abroad. I wish to show that he should naturally be expected—nay desired—

to do so, for although he labors under distressing disadvantages in some respects, he happily enjoys a proportionate share of advantages in others. It is unsatisfactory in the extreme for an enthusiastic entomologist to be obliged to let his collections go out of his own hands, see others reap the honors from them which are to be reaped on such occasions, or perhaps see as it were a gulf close over them, hear no more of them, and find himself forgotten. For what is a mere collector? Let him display as much industry as possible, he is hardly looked upon as an entomologist, certainly as long as he is prevented from publishing anything, not as a scientific one. Now, if such a man merely desists from publishing the fruits of his researches, from want of resources to assist him to go creditably through such a task; if he suffers his collections to go out of his hands because he is too true a lover of science not to see the credit in a great measure due to himself reaped by another rather than to hoard up his entomological treasures—a useless heap eventually to be destroyed by moths and time—I say, that a man who acts upon principles like these, finds himself not seldom disheartened in the prosecution of his studies, under difficulties such as I have set forth. If however, as I have endeavoured to point out, these difficulties can be overcome to a very considerable extent, is anything more natural than that he should be the herald of his own discoveries? Could anything be more unkind and ungenerous on the part of his scientific brethren at home than to oppose and discourage him by their disapprobation? I might enlarge on this subject, which has been a sore one with me for a long time, but I think this is sufficient to direct the reader into the train of my ideas and to enable him to follow it up.

I hasten therefore to conclude. As mentioned above, the tropical entomologist has a proportionate share of advantages to balance what falls to his lot of the contrary. One of the advantages which he enjoys over his brethren at home is, that he has an opportunity of seeing and studying alive what can at home only be examined in a state differing more or less from that of life. Therefore, if he is *enabled* and *expected* to describe new species, it is moreover *highly desirable* for the sake of the promulgation of *sound* information that he should do so, that he should avail himself of this, his principal

advantage and describe fresh from nature, as many of his favourites and their habits as possible; and to discourage him in such an undertaking on any of the above grounds would be to discourage the progress of science in general.

FAM. CARABIDÆ, TRIB. CHLÆNIDÆ.

1. *Chlænius Ceylanicus.* N.

C. subellipticus, subconvexus, glaberrimus, nitidus; supra brunneo-æneus, capite, thoracis elytrorumque margine aureo-viridibus; subtus piceus, margine, pedibus oreque dilute castaneis. Long. corp. $5\frac{3}{4}$ lin.

Caput ante oculos 2-impressum. Antennæ art. 3° quarto paulo longiore. Mentum dente magno excavato. Thorax subquadratus, latitudine parum longior, obsolete punctulatus, antice subconvexus, lateribus deflexus, postice depressus, planus, 2-impressus. Elytra subtiliter striato-punctata, obsoletissime punctulata.

In stagnorum ripis inter arundines habitat, in prov. occid. et merid. infrequenter legi. Per occasionem nocte ad lumen advolat.

A handsome and interesting species, distinguished as well by its general shape, which is more elliptic and convex than usual, as by its polished surface. The head is oblong and, with the exception of the mouth the parts of which are of a deep brown, of a bright metallic green divided longitudinally by a streak of copper color. The thorax is rather longer than broad, rounded in front and flat behind and finely punctured all over; it is of a brownish metallic color bordered laterally with bright green. The elytra are of the some color as the thorax, the same bright green stripe running along the sides. The margin, properly speaking, is deep brown. They are impressed with rows of fine indistinct punctures and with the usual series of larger setigerous ones within the margin. They are rather narrowed near the apex.

The female, in addition to having the anterior tarsi not dilated, has the basal impression of the thorax of a somewhat semi-circular shape, and is broader in the body than the male.

2. *Chlænius 5-maculatus.* N.

C. præcedente major, minus convexus, latior, rugosus, pubescens; supra obscure nigro-viridis, capite viridi-æneo, nitente, glabro, elytris maculis 5 flavis; subtus piceus; pedibus, elytrorum margine antennisque flavis, ore thoracisque margine magis minusve brunneis. Long. corp. 6½ lin.

Caput ante oculos leviter 2-impressum, punctulatum. Antennæ art. 3° quarto plus sesqui longiore. Thorax subquadrato-rotundatus, latitudine haud brevior, dorso planus, ad basin 2-impressus, rugosus, pilosus. Elytra subdepressa, subtiliter striata, rugosa, pilosa, maculis 2 humeralibus, 2 intermediis, 1 apicali flavis ornata.

Specimen singulum m. in lacus Colombensis ripis sub graminibus putrescentibus legi.

Not less distinguished than the former, especially by the rounded shape of the thorax and the 5 yellowish spots with which the elytra are adorned. These are arranged in the following manner: 2 small ones at the shoulders, 2 large transverse ones at the middle stretching from the external margin towards the suture reaching, however, but little more than half across, 1 at the apex; this is of the shape of a hammer, and half in one and half in the other elytron. The palpi appear to me longer and more markedly elbowed at the joints than is usual with insects of this genus, the last joint is deeply excavated at the tip. The thorax is of suborbicular form, the back and hind part are flat, the sides slightly depressed, the margin sharp, the basal impressions very near the angles; it is, as are also the elytra, rough and finely pubescent, the striæ of the latter being thereby rendered obsolete. Legs of m. stout, anterior tarsi strongly dilated.

3. *Chlænius pulcher.* N.

C. elongatus, subconvexus, subglabratus, æneo-viridis, elytris obscurioribus, limbo pedibusque flavis, subtus piceus. Long. corp. 6¾ lin.

Caput oblongum nitidissimum, ante oculos 2-impressum. Mentum dente fortiter excavato. Antennæ art. 3° quarto sesqui lon-

giore. Thorax oblongus basin versus angustatus, parce punctulatus, antice lateribus deflexus, postice dorsoque planus, basi 2-impressus. Elytra striata, ad strias, præcipue apicem versus, subtilissime pilosa, flavo-marginata. Pedes flavi, spinulis castaneis. Abdomen flavo-marginatum.

Specimen singulum m. in ripis Maha-Oyæ fluminis prope Negombo cepi.

Distinguished by its elongate shape. The head is of a bright green color with the labrum and the mandables of deep, and the antennæ and palpi of a light brown, the latter being darkened towards the end. The thorax is of the same color as the head reflecting a copper hue from the back, its anterior angles are obtuse, the basal ones being right. The elytra are of the same greenish copper color but darker, they are impressed with longitudinal lines, which are bordered on each side by a row of minute hairs. They as well as the abdomen have a yellowish margin.

4. *Chlænius cupricollis.* N.

C. subconvexus, subglabratus, capite thoraceque cupreis, elytris nigro-æneis, limbo pedibusque flavis, subtus piceus. Long. corp. m. $5\frac{3}{4}$—f. $6\frac{1}{4}$ lin.

Præcedenti affinis. Caput ante oculos indistincte 2-impressium. Thorax ut in præcedente sed minor, antice lateribus magis deflexus, linea media impressionibusque basalibus longitudinalibus, præcipue in f., profundioribus. Pedes flavi, trochanteribus spinulisque castaneis. Elytra præcedentis.

In prov. occid. fluminum lacuumque ripis infrequenter legi.

Allied to the former but easily distinguished by size, color and sculpture of the thorax. The male is shorter and the female plumper than the former. The thorax is smaller and, as is also the head, of a bright copper color with greenish sides, its impressions, especially in the female, are deeper and its anterior part laterally more deflexed. Moreover the yellowish margin of the abdomen is wanting and the tooth of the mentum is not excavated. The elytra, antennæ and palpi are, making allowances for size etc., those of the former.

5. *Chlænius rugulosus.* N.

C. subconvexus, subglabratus, thorace occipiteque rugulosis cupreis, elytris nigro-viridibus, pedibus, elytrorum limbo lunulisque apicalibus flavis, subtus piceus, abdomine apice margineque flavis. Long. corp. $6\frac{1}{4}$ lin.

Caput fronte 2-impressum, subtillissime longitudinaliter rugulosum. Menti dens laciniis extus rotundatis. Thorax lateribus rotundatus, deflexus, basi sat fortiter angustatus, obsolete 2-impressus, parce punctatus, subtiliter transversim rugulosus. Elytra ut in præcedente sed apice utrinque lunula flava signata, ad strias distinctius pilosa, his apicem versus per paria coëuntibus. Pectus abdomenque picea, hoc segmentis 2 ultimis, præcedente dimidio margineque flavis.

Specimen unicum f. in *Ch. pulchri* N. societate cepi.

Of the general appearance of the preceding two species. The head finely longitudinally, the thorax transversely rugose ; the latter with rounded and deflexed sides. The mandibles are of deep brown, the palpi and antennæ of yellowish color darkened towards the tip. The lobes of the mentum tooth are externally rounded. The elytra are marked by two sub-apical spots of yellowish color and semi-lunar shape (the back of the lunulæ being turned towards the suture). The striae verge near the apex by twos into each other. The abdomen is distinguished by having a yellow margin and apex.

Trib. SCARITIDÆ.

6. *Scarites minor.* N.

S. elongatus, niger, nitidus, subtus nigro piceus, pedibus piceis, tarsis, antennis palpisque castaneis. Long. corp. 5 lin. lat. $1\frac{1}{2}$ lin.

Caput subquadratum, ante oculos 2-impressum, postice irregulariter sulcatulum. Mentum rugosum, medio costatum, lateribus utrinque profunde uni-sulcatum, lobis obtusis, dente forti, lobis paulo breviore. Maxillæ validæ, breves, apice extus leviter arcuatæ et excavatæ, subacuminatæ. Mandibulæ validæ, inter medium et basin fortiter dilatatæ, obtuse dentatæ, dextera dente obtuso subapicali,

supra subtusque longitudinaliter sulcatæ. Antennæ art. 1º sequentium trium—2° tertii prope longitudine. Thorax oblongo-quadratus, angulis anterioribus obtusis, posterioribus oblique truncatis, anguste marginatus. Elytra thoracis capitisque prope longitudine, striata, ante medium ad striam 2m uni—apicem versus ad striam 3m 2-punctata, punctis piliferis, basi granulata, angulis oblique-truncatis, anguste marginata. Pedes anteriores tibiis apice extus 5-dentatis, dentibus 2 ultimis parvis, omnes tarsis subtus leviter excavatis.

In prov. occid. arenis humidis sub vegitabilibus putrescentibus specimina nonnulla legi.

Scarce and but little distinguished excepting by its size, for which reason, a lengthened description makes itself necessary. The head is subquadrate, in front with 2 deep longitudinal impressions, behind the eyes finely sulcated. The labrum is of the usual shape, the eyes are not very prominent; the antennæ are of about the same length as the head, the first joint is about as long as the 3 following together, the 2nd, which is generally longer than the 3rd, is in this case of the same length, joints 1—4 are naked, 5—11 pilose, increasing towards the tip gradually in size and thickness, taking at the same time a subquadratic and depressed shape. The mandibles are strong, much dilated and dentated from before the middle to the base, the right one having an additional subapical tooth. The maxillae also are strong, but slightly bent at the apex, where they are also slightly excavated. The labial palpi have the last joint longer than the 3rd, elongated and elliptic. The thorax is oblong with the basal angles obliquely truncated. The elytra are oval, striated, granulated at the base, and have, as has also the thorax, a narrow margin. The anterior tarsi are furnished externally with 5 teeth, the 2 last of which, however, are very small, the posterior legs are similarly provided, but the teeth are indistinct. The joints of the tarsi are slightly excavated below. The sides of the body below are rugose.

7. *Clivina rugosifrons.* N.

C. ferruginea, capite, thorace abdomineque piceis. Long. corp. $4\frac{1}{3}$ lin. lat. $1\frac{1}{3}$ lin.

Caput rugosum, inter oculos elavatum, elevatione plana antice profunde 1-impressa. Mentum lobis subtiliter sulcatis. Antennæ robustæ, thoracis medium vix attingentes, art. ultimo elongato, penultimo—, art. 2° tertio sesqui longiore. Thorax subquadratus, antice parum angustatus, elytrorum latitudine, subtus parce punctatus, prosterno sulcato. Elytra striata, in striis punctata. Pedes tibiis anterioribus apice extus 4-dentatis, subtus excavatis, tibiis reliquis fortiter spinosis, tarsi articulis margine apicali setoso.

In prov. occid. sub vegetabilibus putrescentibus infrequentissime legi.

A large and distinguished species. The head is very rugose, the clypeus is contracted behind the apical angles and then produced again into another pair of angles. The labrum is transverse, slightly sinuate in front, with the angles rounded and setose. The mentum is quadrate, the lobes rounded at the apex and slightly sulcated, the tooth is strong, of equal length with the lobes and of the typical spearheaded form. The ligula has the apical angle much elongated, terminating in a membranaceous bristle which is bifurcate at the tip. The maxillary palpi have the last joint elongate, cylindrico-conic; that of the labial ones is still more elongate, elliptic. The antennæ have the basal joints elongate, those towards the tip rounded. They and the legs are hairy, otherwise the insect is of a bright polished surface.

8. *Clivina elongatula.* N.

C. elongata, subdepressa, supra nigro-picea, subtus picea, pedibus elytrorumque margine castaneis, antennis oreque dilatioribus. Long. corp. vix. 3 lin. lat. $\frac{3}{4}$ lin.

Caput triangulare, subtiliter punctato-rugosum. Palpi articulo ultimo apice leviter truncato. Thorax oblonge quadratus, ante apicem leviter sinuosus, parce obsoleteque transversim strigosus. Elytra striata, in striis punctata, ad striam 3^m utrinque 4-punctata. Subtus parce punctata.

Ubi præcedentem specimen singulum legi.

I have not dissected the labium of this species, which, however,

is at once recognised by its depressed and, in proportion to its width, very long shape. The labrum, antennæ and legs are so much like those of the former that they need no further description. The bristle of the ligula appears simple.

9. *Clivina maculata.* N.

C. picea, elytris ferrugineis infra medium macula nigra indistincte ornatis, pedibus intermed. et post. oreque brunneo-testaceis, pedibus ant. antennisque obscurioribus. Long. corp. 2 lin.

Caput oblonge quadratum, rugosum, costis 5 magis minusve interruptis ad marginem anteriorem dentibus 4 productis munitum. Palpi art. ultimo basi intus incrassato. Antennæ art. 2-3 subæqualibus. Thorax subquadratus leviter rotundatus. Elytra striata in striis profunde punctata.

Ubi præcedentes specimen singulum legi.

As distinguished as the preceding two species. The palpi and the mentum appear to me of a somewhat extraordinary form. The last joint of the former is considerably more inflated at the base than in any other Ceylon species that has hitherto come under my notice, whilst the others are of a very curved appearance in both the maxillary and labial palpi. The emargination of the mentum would at first sight appear to be of a semi-lunar shape. However, it is only the lower margin which has this form, the oblique truncature which forms the emargination being such as to give it that shape. The tooth is of the typical shape, but being on a level with the lower margin, it stands at a small angle with respect to the inclined plain formed by the rest of the truncature. The apical angles of the lobes are somewhat pyramidal being formed by 3 sides. I have not dissected the labium, therefore do not know whether the remaining parts exhibit any peculiarities. The insect is however, easily distinguished by its general facies, which is rather like that of a *Dyschirius*, from which genus, however, the mentum alone is sufficient to separate it. I may as well remark here that, although the Island is well supplied with *Scarites* and *Clivanæs*, I have hitherto not discovered a single *Dyschirius*, a genus so well

represented in Europe. Of the three *Clivænas* just described, single specimens only have been in my possession for a considerable time. There are three or four more species met with about Colombo but these being of common occurrence I abstain from describing them here as they may possibly be amongst those described by Putzeys or others from the Indian continent.

Fam. RHIPIPHORIDES.

10. *Rhipiphorus tropicus.* N.

R. niger, nitidus, elytris albidis, nigro-maculatis, labro palpis, antennis (pectine nigrescente excepto) unguibusque brunneis, impresso-punctatus, punctis magnis sed non profundis, subtus suborbicularibus piliferis, supra oblongis lævibus. Long. corp. $2\frac{1}{3}$ lin. lat. ad humeros $\frac{3}{4}$ lin.

Caput oblongum, latitudine paulo longius, parte frontis inferiore dense profundequê punctata, vertice obtuse obconico glabro, nitidissimo, occipite piloso. Thorax elevatus, ad basin 2-impressus, medio angulo obtuso, apice excavato, glabro, inter elytra producto. Elytra ad suturam utrinque stria lata brunnea punctata impressa, acuminata, apice dehiscentia, albida vel subhyalina, apicibus, medio utrinque et ad basin nigro-maculata. Alæ apice fuscæ. Pedes tarsis anticis art. 2-4 unguibusque bifidis omnibus brunneis, tarsis subtus setosis, anticis art. 2—3 primo que apice, subtiliter sericeo-penicillatis.

Specimen singulum m. prope Colombo, in floribus legi. De metamorphosi adhuc nihil constat.

The head is rather long in proportion to its width, the occiput is narrowed, short obconic. The hind part of the thorax is elevated above the elytra. The central part of its base is prolonged between the elytra in an obtuse angle, the apex of which is abruptly truncated, excavated and polished. The labrum is hairy and the ungues of the tarsi bifid as usual.

The tibiæ of the anterior legs are furnished at the apex with one, those of the 4 posterior legs with two spurs. The anterior tarsi

have joints 2-4 brown. The tarsi are setose below joints 2-3 and the apex of the first of the anterior ones wearing fine yellowish silky brushes instead.

All over the Island the *Rhipiphorides* and *Mordellinæ* appear to be very scarce, with the exception of 1 or 2 species of *Anaspis* which are not occasionally taken in flowers. Still I recollect having met with about seven species including two large *Mordellæ* which however I have not been fortunate enough to catch as yet.

Fam. STAPHYLINIDÆ. Trib. PINOPHILINI.

11. *Œdichirus alatus.* N.

Œ. alatus, setosus, nitidus, rufo-testaceus, thorace dilatiore, capite, elytris abdominisque segmentis 3 ultimis nigris ; elytris apice 2-maculatis, maculis rufo-testaceis ; pedibus flavis, femoribus apice tibiis que basi nigrescentibus ; autennis palpisque maxill. basi obscuris, apice testaceis, reliquis oris partibus rufo-piceis. Long. corp. $3\frac{1}{6}$ lin.

Œ. pæderino Er. simillimus, præter colorum distributionem differt tamen *alis*, elytorum antennarumque articuli ultimi sculptura. Antennæ art. ultimo penultimo æquali nisi paulo minore, apice fortiter *truncato* leviterque excavato. Thorax *Œ. pæderini,* dorso punctis biseriatim impressus, serie interna vel centrali elliptica punctis minoribus magis inter se approximatis, externa vel submarginali punctis magnis distantibus. Elytra oblonge subquadrata, infra medium rotundata, thorace *longiora* et fere duplo ampliora (utrumque elytron thoracis fere magnitudine), basi parte thoracis adjacente *duplo*—infra medium illius latitudine antica plus tertia parte latiora. Os, pedes et abdomen *Œ. pæderini.*

Pæderorum more victitare videtur ; in eorum societate in lacus Colombensis ripis infrequentissime legi ; illis minus gracilis atque minus agilis.

I have not had an opportunity of examining specimens of either of the three *Œdichiri* hitherto described. However, I have before me Erichson's figure and description of the Sicilian *Œ. pæderinus* with which I find my species strongly to agree.

It differs, however from the former materially in the following three points, viz., the wings, the sculpture of the wing-covers and the last antennal joint. The fact that this species has wings would render an alteration in Erichson's diagnosis of the genus necessary, it being characterized therein as apterous. The elytra are not so much contracted and rounded at the base, and, being longer than the thorax, have therefore a more oblong, subquadrated appearance. As in the above typical species they are however, rounded at the sides and broadest a little below the middle. They are about twice as broad at the base as the adjoining part of the thorax and in their largest part, rather more than a third broader than the greatest breadth of the thorax. The third point in which the two species differ is the last joint of the antennæ, which in this case is strongly truncated at the tip and slightly excavated. They are further distinguished by the distribution of the colors; my species being of a dark yellowish red, thorax lighter, head, elytra and three last abdominal segments black, elytra with 2 reddish spots at the apex, legs yellowish, at the apex of the femora and base of the tibiæ blackish, the mouth is brown, the maxill. palpi yellowish with the three first joints dark at the base, the antennæ have the 6 basal joints dark excepting at the apex where they as well as the 5 remaining ones are yellowish. In all other points I find the insect entirely agrees with the typical *Œ. pæderinus:* the palpi, legs and anal segment of the abdomen are of the same structure, the hairy vestiture is exactly the same in the different parts of the body of my species as it is in the corresponding ones of Erichson's.

It is perhaps wrong in me to describe an isolated species of this extensive and difficult family. However, the gen. *Œdichirus* is one so extraordinary that I am sure it will be noticed wherever the description of a new species of it may be found, be it by itself or amongst those of other *Staphylinidæ*. The case would be different if the object of the description were a *Homalota* or the like.

IV. *Description of a Plain or Waxed paper Process in Photography. By* JESSE MITCHELL, *Adjutant 1st Native Veteran Battalion.*

So much has been written on the paper processes that the subject would appear to be exhausted. Nevertheless a good paper process, easy to manipulate and applicable to all situations appears to be still a desideratum, I have therefore, at the request of our Honorary Secretary, undertaken to describe my mode of operating, and I believe that any one who faithfully follows these directions will, after a little practice, find no difficulty in producing, at least, tolerable negatives. Skill in Photography as in any other Art, or Science, is only acquired by practice, and no reasonable man should feel annoyed if in his first attempts, he fails to produce as good pictures as those who have practised assiduously for many years.

This process is a modification of the original waxed-paper process of Le Gray, but it is equally suited to unwaxed papers. As the manipulation of unwaxed paper is much the easiest and the results so much alike that the operator himself cannot, after a time, say which was taken on waxed, which on plain paper. I shall confine myself to a description of the latter process, giving afterwards such additional directions as may be necessary to adapt it to waxed paper.

In Photographic operations, absolute cleanliness is an essential element of success. It is not sufficient that the Photographer's hands, for instance, be mechanically clean, they must be chemically so, therefore when he is about to select his papers, he should not be satisfied with the usual washing with soap and water, but should rinse them afterwards in a good quantity of clean water, lest the soap do that mischief it was intended to prevent. This applies still more strongly to the trays used in the various stages of the process. The Tray used for Iodizing the paper should be used for that purpose alone, or if from the paucity of apparatus which in this country is not always procurable, he is compelled to use it for the exciting solution also, that is the greatest liberty he may take. The

exciting dish must never be used for developing, and the dishes for developing solutions should not be used for any other purpose, except washing the paper after it is excited, in which case if clean they are not likely to do any harm. After being used with Gallo-nitrate they should be washed as soon as possible in abundance of clean water, and if the Gallo-nitrate solution decomposes rapidly when placed in them, they must be washed with a weak solution of Cyanide of Potassium (5 grs. to one ounce of water), and with plenty of clean water afterwards. The trays for Hypo-sulphite cannot be used for any other purpose except for washing the finished negative. The Photographer will also find it advantageous to have separate measure and funnels for his Aceto-nitrate and Gallic-acid solution.

Paper.

The paper used in this process is Canson's thin Negative. It is not without imperfections, such as unevenness of texture and minute holes which allow the exciting, and developing solutions to pass through and stain the back of the negative. To the beginner these things are not of much importance, as he must expect to spoil a few papers, but when a little more advanced, he should examine his papers carefully by a strong light, rejecting any that have the imperfections above noted which need not however be thrown away, as the best will do for waxing which fills up any very small holes, and the remainder will do for Positives. The papers should be cut of the same width and half an inch or so longer than the Camera slide; one side of the paper is smoother than the other which is best ascertained by holding it so that the light falls upon it obliquely; this should be marked in two opposite corners with a capital letter, which better defines the side on which the mark is made than a circle or cross.

Iodizing.

The solvent may be either whey or distilled water, I believe the former produces the most dense skies and a greater opacity generally in the dark parts of the picture, it is however somewhat troublesome to prepare:—the following method of obtaining it, is perhaps as good as any.

Let pure milk from the cow stand until it is sour, for each quart of milk beat up the whites of three eggs; add these to the milk in any convenient vessel, porcelain is best—if brass or copper utensils be used they should be well tinned. Boil gently over a slow fire for a few minutes and the caseine will be taken up by the coagulated albumen. When cold, filter through a double fold of cambric, and then through bibulous paper, the latter is a tedious process unless the operator has a large funnel which he can fill and leave whilst he is attending to other matters. If properly made it should be clear and transparent and of a straw colored tint.

To each ounce of whey or distilled water add the following ingredients—

Iodide of Potassium........................	grs.	$7\frac{1}{2}$
Bromide of Potassium.......................	„	$2\frac{1}{2}$
Cyanide of Potassium.......................	„	$0\frac{4}{10}$
Chloride of Sodium, dry, (table salt)..........	„	$0\frac{1}{2}$
Sugar of Milk................................	„	12
Crystallised Honey (from the bottom of a jar)...	„	5

Dissolve, and add to the mixture as much re-sublimed Iodine as will produce a brown sherry color: try 10 or 12 grs. to the quart of 40 ozs.—and if that is found insufficient, add more, as the exact quantity is of no importance. The Iodine being rapidly extracted from the solution by the starch in the paper will require to be renewed occasionally, the necessity being indicated by the paleness of the solution. It is some hours before the whole of the Iodine is dissolved.

Filter the above solution into a dish to the depth of one inch, or more if the dish is deep enough. Take a paper by two adjacent corners and place the other end upon the solution so as just to touch it, without pause lower the hands gradually and carefully to exclude air bubbles, for the better seeing of which the iodizing tray should be placed between the operator and a window. Let the paper lie for a moment until it is wetted, then take it up by the corners nearest to you and place the other side of the paper upon the solution in the same way. Then by the help of a bent glass rod, or by tilting the tray, cause the solution to flow over the paper.

Should air bubbles be present, they will be indicated by that portion of the paper remaining uncolored. Put in as many papers as the tray will hold without crowding. When all are in, remove in succession the bottom paper to the top, turning it as you do so, this will enable you to see if the whole have been properly immersed. The dish should be shaken occasionally to prevent the papers adhering to each other, which they have a tendency to do, and which is shown by light patches where the free access of the solution has been prevented. The papers may be immersed from 2 to 3 hours, and then hung up to dry.

The best mode of suspending iodized papers is to hang up each sheet with two of the American spring clips, made of Beech and sold in London at 1 shilling a dozen, they are to be strung upon a piece of bobbin or thin cord, and stretched across a room that is free from dust, which would soil the papers,—and from strong draughts of air, which would tear the paper out of the clip.

An additional precaution which I found necessary to prevent staining is to prepare some strips of new blotting paper, as wide as the clips and about $\frac{3}{4}$ of an inch long, fold these in two, and having taken up a paper by two corners, let an assistant drop one of these papers on each corner close to your fingers, he then opens a clip and you put in one corner of the paper, where the blotting paper is, you will find it most convenient to open the second clip yourself. A small strip of blotting paper should be placed at each of the lower corners to facilitate draining, and prevent an excess of the iodizing materials from lodging there, which will be the case if this is not attended to.

When the papers are dry, trim off the half inch in excess of the length of the slide from whichever end appears most to need it, and put them by in an envolope made of course drawing paper, which should be kept in a portfolio, or a tin case made for the purpose.

Thus far the operations may be conducted in any convenient room, but those which I am about to describe must be carried on in a room fitted up for the purpose, and into which no ray of white (or common daylight) must be allowed to enter whilst either excit-

ing, or developing papers is in progress. This we will call the operating room.

Where circumstances permit, the best light is obtained through a ruby coloured glass, made for this purpose, one or two moderate sized panes of this should be fitted into a window or door, if possible at the level of the table, that being the most convenient direction of the light in many Photographic operations. The light thus procured will not affect Collodion (unless the sun shines upon the glass) and is so abundant as to permit everything to be seen with the greatest comfort. Where this mode of fitting up a room cannot be adopted, a double fold of long cloth, or close woven country cloth, dipped in an aqueous solution of Turmeric, and made to sit close to the wall, makes a curtain that obstructs the actinic rays, and admits a considerable amount of light, but not so much as the glass.

To excite for the Camera.

The exciting solution consists of,

Distilled water....................................	oz.	1
Crystallized Nitrate of Silver..................	grs.	25
Glacial Acetic Acid (half a fluid dram).........	mins.	30

This solution should either be kept in a yellow glass bottle, or in a bottle with a wooden or dark pasteboard cover, as although Aceto-nitrate of Silver is not liable to be decomposed by daylight when the chemicals are pure, it becomes so after contact with the organic matters contained in the iodized paper.

Filter as much of this solution as will cover the dish to the depth of a quarter of an inch. Float the marked side of the paper on it for four minutes—taking care that there are no air-bubbles. These, if any exist, will be indicated (in from 30 to 60 seconds,) by that part of the paper remaining of a dark colour—whilst the remainder is becoming white (apparently, but in reality of a primrose yellow colour.) Have ready a dish with distilled water and float the excited paper on it for a minute or two, this removes the excess of Nitrate (perhaps some Nitrate of Potash, &c.), and makes the paper keep longer without becoming discoloured. On a clean table, or a board kept for the purpose, put 3 or 4 folds of blotting

paper with a fresh piece on the top, on this lay the wet side of your paper, and cover it with another piece of fresh blotting paper —blot off the excess of fluid by passing the hand lightly and equally over it. Then put in between fresh blotting paper and place it in a drawing paper envelope, which may be deposited in a portfolio or a flat tin case made for the purpose, until required to be put in the slide. This should not be done for about half an hour, unless it be intended to expose it immediately, as the evaporation from the paper is condensed upon the glass, and forms a number of small plano-convex lenses which doubtless refract the rays that have passed through the glass of the slide and injure the picture.

I have not had occasion to keep this paper longer than 18 hours after exciting, it kept well for that time.

Exposure in the Camera.

With a given paper and light, the time of exposure will depend upon the focal length of the lens, and the aperture of the diaphragm in front of it. My pictures were taken with a Ross' 4 inch Landscape lens of 20 inches focus, with an aperture of ½ an inch in the diaphragm. And the time of exposure I found necessary will be the best guide I can give to others.

I took a good negative of the Catholic Cathedral in 9 minutes, between 3 and 4 P. M., the paper having been excited about half an hour previous to exposure in the Camera. This is a white building much darkened by time. There were some deep shadows, the detail in which is fairly rendered: the Cassarina trees also would have been tolerably well represented, had it not blown very hard at the time. During half the time of exposure, the sun was obscured by a small, but dense, black cloud. The Museum was taken between 7 and 8 A. M. on paper excited on the previous evening, it was exposed 9 minutes in bright sunshine. This was perhaps exposed rather too long to be called a good negative, although not altogether to be despised. It need not have been made quite so intense, but there was a palankeen carriage and horse in very deep shadow under a large tree, which I wished to bring out, or else the development could have been stayed earlier. These

pictures were developed in 23 and 24 minutes, $\frac{1}{12}$ of the volume of Gallic-acid, being added from the exciting solution.

The amount of exposure for any focal length and aperture being known—the time necessary for any other lens is found by the following rules, viz. :—

With lenses of the same focal length, the time of exposure is inversely as the square of the diameter of the aperture in the diaphragm.

With the same aperture and different foci—the time of exposure is, directly as the square of the focal length.

With different apertures and foci, the times of exposure are, inversely as the square of the diameter of the apertures, and directly as the squares of the focal lengths.

The correct time of exposure however is one of the Photographer's difficulties, and requires some considerable experience to adjust accurately under every kind of light.

Developing Solution.

Some hours before it is required to be used, fill a large stoppered bottle with distilled water, put in a piece of camphor, the size of a nutmeg, and some Gallic-acid, the exact quantity is of no consequence, so that it be in excess. Upon an emergency the solution of the Gallic-acid may be accelerated by putting the bottle (without stopper) in a jug of hotwater. The Photographer however should be careful to have a saturated solution, always, or there will be no certainty in his practice.

Filter as much of the above solution into the developing tray as will cover it to the depth of at least one-eighth of an inch, and then examine the state of your negative.

If by the light of a taper, the outline of the upper part of the buildings or trees,* is just plainly visible, the paper is in the best state for developing and you should add to the Gallic-acid about $\frac{1}{16}$ of its volume of the exciting solution. If the sky line is very strongly marked, add $\frac{1}{20}$ to $\frac{1}{24}$, and if the paper has been so long exposed as to bring out the brighter parts of the view, you may perhaps save it by omitting the Aceto-nitrate altogether or even, in extreme cases, diluting the Gallic-acid,—adding a small quantity

* "Technically known as the sky line."

of the Silver solution, when the detail is nearly all visible; on the contrary, if the sky line be entirely invisible add $\frac{1}{12}$ of the Aceto-nitrate solution.

Tilt the tray to and fro half a dozen times to ensure the perfect mixture of the solution, or you will have patches of unequal development.

Float the marked side of the paper on this as before described, and be careful that no portion of the solution is allowed to touch the back of the paper—should this unfortunately happen, as it sometimes will notwithstanding every precaution, instantly reverse the paper and wet the whole of the back as the only way to avoid a stain—turning it again as soon as the back is wetted thoroughly and developing by immersion. Should there be an insufficiency of Gallo-nitrate to cover the paper well, get an assistant to pour in more whilst you hold the paper, replacing it face downwards as soon as the solutions are mixed.

The sky and most strongly illuminated parts of the picture first appear, then the portion more in shade. When the darker parts become visible through the back, lift one end between yourself and the light, if the detail in the least brightly illumined parts is at all visible, take it up and examine it carefully. If satisfied that you have obtained as much detail in the shadows as can be done without too much intensifying the high lights, remove the paper at once to a pan of clean water and plant it face downwards to allow any decomposed Gallo-nitrate to fall to the bottom of the pan, then pour off the water or, what is better, remove the negative to another vessel of clean water. If from the length of time occupied in the development or any other cause, decomposition of the Gallo-nitrate has taken place to any extent, the face of the negative may be very cautiously brushed with a small camel's hair brush. After washing in 4 or 5 changes of water for half an hour remove it to the fixing solution.

FIXING SOLUTION.

This consists of 3 or 4 ounces of Hypo-sulphite of Soda to 1 pint of clean (not distilled) water—in which the negative is to be left until all the yellow Iodide of Silver is dissolved, this can only be ascertained by daylight which will not hurt the picture after

it has been some time in the solution—still it is not prudent to expose it to too strong a light (such as sunshine) until the Hyposulphite has been washed out.

When all the Iodide of Silver is removed, wash in three or four waters in succession, and then leave it in a large quantity of water for 3 or 4 hours, changing the water every half hour, after which pin it up to dry,—(pins do no harm now). When thoroughly dry, it must be waxed in one of the following ways.

To Wax Paper.

A dish of double block tin, without joints in the bottom and one inch deep, is made to fit into another and larger vessel, also of tin, containing boiling water which must be kept at the boiling point by any convenient heater. A cake or two of white wax is put into the waxing dish, and when it is melted the sheet of paper is floated thereon, when the paper is saturated with wax take it up and drain off as much as possible of the superfluous wax. Do the same with any number of papers. Then with a clean box-iron—iron them one at a time between from 4 to 6 thicknesses of blotting paper until the blotting paper is saturated with wax; then iron between fresh blotting paper, which may require to be repeated. The 2nd and 3rd papers of the 1st batch will do the 1st and 2nd ironing of the 2nd batch. Proceed thus until all are ironed and appear (when held between the eye and the light) free from any opaque, or shining spots—and perfectly clear and transparent.

Another method of waxing papers is to place the paper on two or three folds of blotting paper; then as you pass the iron over the back of the paper with one hand follow it closely with a piece of wax held in the other, the excess of wax being ironed out as before, I do not recommend this mode of waxing papers previous to iodizing, but it answers very well when one or two negatives have to be waxed, and must do when the Photographer is unprovided with a tray.

After the negative is waxed the edges should be trimmed, it is then ready to print from. In taking out the superfluous wax from the finished negative, as hot an iron as possible should be used to remove the wax, for notwithstanding all his efforts to extract the excess, he will, not unfrequently, find by the spots in his print,

that the Sun has done what he was unable to effect. For the glass plate of the printing frame becomes so hot as to transfer the wax from the negative to the positive, through the coagulated albumen.

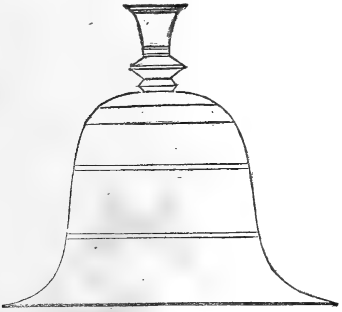
Having said all that appears to be necessary on the subject of unwaxed paper, I will add what may be necessary to enable the novice to use waxed paper. He will find at the outset that it is much more difficult to immerse waxed papers in the iodizing solution, the difficulty is lessened when there is a good depth of solution, I have also found that the papers are more easily immersed in a solution made with whey than in one prepared with water. In exciting waxed papers, float twice the time directed for unwaxed papers. They will require about five thirds the exposure, and generally, the development, fixing, and washing of waxed papers will require a longer time. With these exceptions the manipulation is the same as with plain papers.

In conclusion I have only to add, that the method of manipulating is that followed by Captain Tripe and Dr. Neill, which will recommend it more to your notice than anything I can say in its favour. They do not soak their papers so long in the iodizing solution as I recommend. It was an experiment with me, and the result having proved satisfactory, I of course direct you to do that which has succeeded in my hands. But I am not certain that such lengthened immersions are necessary, though I am quite satisfied they are not injurious. The iodizing compound contains nothing new to Photography, but the proportions are different from any published formula, I believe. How much of its greater rapidity of action is due to that (or perhaps the longer immersion in the iodizing bath,) I am not prepared to offer an opinion, because neither my leisure nor circumstances permit me to enter into numerous experiments. But I know it is considerably quicker than any modification of the waxed-paper process that I have tried, it is as quick as the Calotype, and I think is deserving of a more extended trial by Indian Photographers than an Individual has the power to give it. It is doubtless capable of improvement, and the probability of this will increase with the number of hands that can be induced to give it a trial.

V. *Description of the Manufacture of Biddery Ware.* By GEORGE SMITH, M. D., *Residency Surgeon, Hyderabad.*

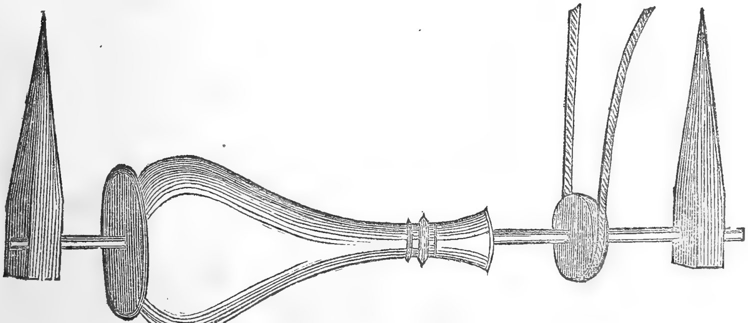
[Communicated by the Committee of the Madras Exhibition for 1857.]

On passing through Beder about two months ago, I thought it would be well, to make a few enquiries into the mode of manufacturing the unique and elegant ware commonly called Biddery; accordingly I procured two workmen, who, partly shewed and partly explained to me the several stages of the manufacture; the information thus obtained may assist those desirous of imitating his beautiful ware.



No. 1.

Suppose the vessel to be made, resembles in form the common small hookah bottom (vide Fig. No. 1). The steps of the manufacture are as follows—A mass of finely pounded and sifted old laterite dust mixed with cow-dung, is put upon a rude lathe, and when dry is carefully turned into the correct shape. The lathe is rude and simple, and is turned either by the hand alone, or by a short rope attached to a small piece of wood (vide Fig. No. 2);

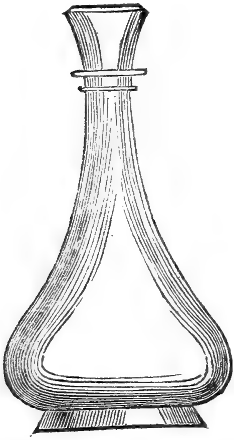


No. 2.

with the other hand the workmen holds a sort of chisel (vide Fig. No. 3), with which he cuts and smooths the model. The model

No. 3.

thus carefully prepared, is next covered with a mixture of wax and oil boiled together (vide Fig. No. 4), when dry, the whole mass is again turned, carefully thinned and smoothed. Over this coating is plastered a second layer of laterite dust moistened with water but without cow-dung—this coat is rough, and is not subsequently smoothed down, (vide Fig. No. 5). The next stage consists in boring two openings in the composite mould, and in placing it in the fire, the effect of this being to melt the intermediate layer of wax, and thus to leave a vacant space for the reception of the alloy. Into this space is poured the alloy (consisting of copper 1 part and pewter 4). The vessel has now a dull leaden look; it is hard, but easily cut. This model or shell is carefully turned and smoothed. Upon the smooth surface of this shell, the pattern is etched by hand, a small pointed graver (like the pattern of the chisel, but only sharper at the point) being used. This etching is done rapidly. The workman next takes a small chisel and hammer, and following the lines of the pattern, cuts it deeply and expeditiously, scooping out the tracings of the little leaves, &c., and leaving an indented but rough surface. This rough surface is next smoothed down by hammering gently



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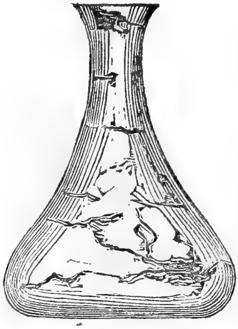
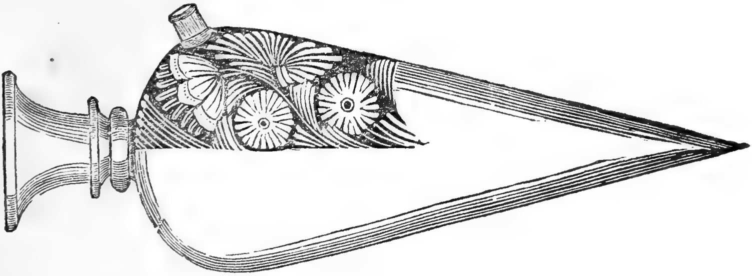


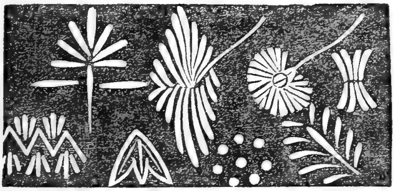
No. 5.

with another blunt pointed chisel, and the space is then ready for the process of inlaying (vide Fig. No. 6).



No. 6.

Thin plates of very pure silver are taken, and the little leaves (vide Fig. No. 7) are cut out with a small hammer and chisel,



No. 7.

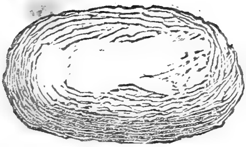
each little leaf is then raised separately by the chisel and finger tip, and hammered gently but carefully into the depression intended for it. This part of the process is tedious. In the more durable kinds of Biddery ware silver wire is substituted for the silver leaf. The vase in this state is rough and requires smoothing. This is done with a common file and with a curved scraper, of a rude and clumsy form. The hole in the bottom of the vessel is filled up with lead and is smoothed down. Finally the vase is gently heated, and whilst warm, is blackened by the application of a powder, supposed to consist of chalky earth and muriate of ammonia, this imparts a brilliant black polish to the shell, and careful hand rubbing brings out the lustre of the silver.

The value of the ware depends upon the thickness of the silver inlaying—the common ware of the bazaars rarely lasts long. Inlaying is also executed in the same way with copper leaf, but the artistic effect I think, is inferior to the silver. The price of a small hookah bottom like that described varies, in Beder, from 7 to 10 Rs.

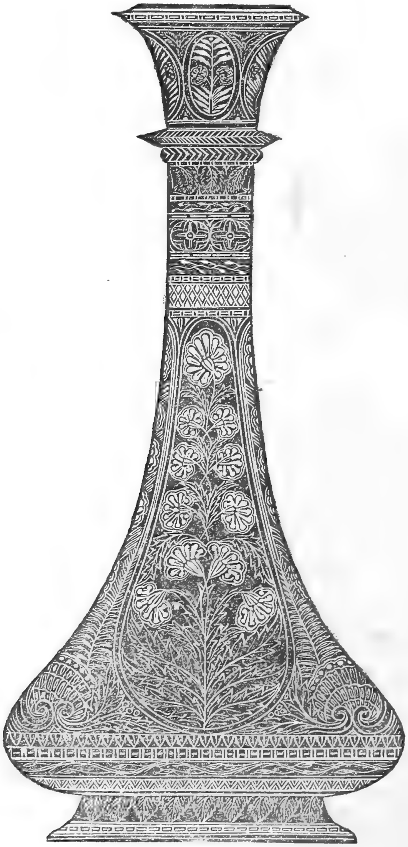
It might be worth while to ascertain, if any intelligent workman at Madras would undertake to imitate this elegant and durable manufacture.

The following patterns are forwarded: they will illustrate the several stages of the manufacture.

1. The first dust and cow-dung model. 2. The wax coating. 3. The rough compound model. 4. The shell, showing also the graving, the scooping out, and the inlaying processes. 5. Half finished shell. 6. The cutting chisel. 7. The silver leaf—with an oval leaf cut out. 8. The polishing powder.



No. 8.



No. 9.

[No. 8, is a fac simile of a cake of laterite dust and cow-dung sent for inspection. No. 9 shows the appearance of a vessel after the inlaying process has been accomplished.]

VI. *Notulæ Botanicæ No. I. On the Sand-binding Plants of the Madras Beach. By* HUGH CLEGHORN, M. D.

Having lately been requested by the Military Board to examine the condition of the South Beach, between the Saluting Battery and Saint Thomé, with a view to consolidate the drifting sand thrown up near Colonel Cotton's groynes, I endeavoured to estimate the comparative value of the different species of maritime plants in preventing the encroachments of the sea on the land, and in fixing the loose soil along the shore. All that seems worthy of mention has been condensed in the following short notice of these useful plants, which originally appeared in the *Journal of the Agricultural and Horticultural Society of India,* vol. IX. part II.

The wide-spreading roots and under-ground stems of the sand-binding plants extend themselves in quest of food, and thus become interwoven together, so as to sustain the soil in a sort of basket-work, and consolidate the sands thrown up by the waves of the ocean. If it were not for the subterranean stems of these sea-side plants, which can vegetate amidst dry and drifting sand, the banks which man heaps up as a barrier against the sea would be blown away by the first hurricane. In Holland, the great sea-dyke preventing inundation, owes its stability to these plants, creeping Gramineæ are employed, which are carefully protected under the instruction of Government. Along the shore of Great Britain, as in Lincoln, Suffolk, &c., the quantity of dry land has been much increased by the propagation of the Bent star or Sand Carex (*Carex arenaria*) and Lyme grass (*Elymus arenarius*).

Let us cast a glance at the localities under consideration. On this low coast, the wind which blows alternately over the sea and from the land, but more continuously from the sea, propels landwards the sand, which collects in a succession of parallel ridges—these gradually advance, and year by year fill up any hollow declivities, or gain on the vegetable soil which is buried. The ac-

companying figure will illustrate the way in which hillocks are formed by the constant encroachment of sand.

This figure is intended to represent sand-hills placed perpendicularly to the direction of the prevailing winds. The wind pushes the sand from the bottom *a* to the top *b*, it then falls in the direction *b c*. A hillock therefore will always increase if fresh sand is supplied in front, or be removed, if the sand be kept continually in motion.

Sandy and irregularly irrigated soil can only produce shrubby and herbaceous plants; it's vegetation, suspended during the dry-season, revivifies during the rains, and covers with a transitory carpet of verdure, the earth which appears naked and sterile during the rest of the year.

The drifting in of great masses of sand is, I understand, one of the greatest obstacles to the perfect success of the Eastern Coast Canal, now in progress near Madras. The drift occurs from both sides, but chiefly from the sea.

Along Canals, in which the level of the water is nearly constant, the banks at different heights are in different conditions of moisture and frequently also of soil: so we see certain species of Grasses, Bulrushes, &c. placed above each other in regular narrow parallel bands forming a kind of girdle, beyond which the soil becomes too dry on one side, and too wet on the other, for them to prosper.

1. *Spinifex squarrosus*, Linn. the species known to Europeans by the designation of "Ground Rattan"* comes nearest to the *Sand Carex* of England in its habit of growth, creeping along horizontally sometimes above, sometimes below the surface of the earth, emitting roots and shoots at short intervals of a few inches. It likewise possesses the advantage of being extremely tenacious of life; the shoot at every node is capable of renewing the existence of the individual

* Also called "Sea Pink," these names are both popular misnomers, the correct designation is "Spinifex" of Botanists. The Tamil name, *Ravanen mise*, i. e. Whiskers of Ravanah, is a descriptive epithet.

as fast as destroyed, and the whole plant offers a resistance to the storm which is rarely overcome. I think this species would be nearly as indestructible from natural causes as Couch grass, and it appears to me (after watching patches of it on the road to Ennore, where it is little disturbed) that it would speedily colonize the sand tracts spontaneously, if it were only left unmolested for a year or two. In the experiment lately made in front of the Fort, and near the Saluting Battery, this binder has answered well, notwithstanding the frequent disturbance of the young plants. The fishermen do not appreciate the conservative design of this "ground rattan" or mat grass, but collect it for fuel, and thus destroy their greatest protection: the reason seems to be that the spiny leaves injure their naked feet, and the turf does not answer for spreading their nets upon. On this account, it would be well to propagate the other plants mentioned, immediately in front of fishing villages. This grass is *Polygamo-diœcious*, (Spinifex dioicus of Ham. MS.S.), and reproduction is effected in a very remarkable manner; the male spikes congested into an umbel are carried by the wind to the female flowers, which are fascicled on a distinct plant, and being light and spherical, the Dutch call them wind-ball (Wind-boll).

Rumphius in the "Herb. Amboinense" alludes to this plant, as being connected with a superstition among the natives, who, seeing the capitula carried along the shore by the sea-breeze, think they are propelled by the devil. (Vide Plate No. 2).

2. *Ipomœa pes-capræ,* Sweet. Goat's foot leaved *Ipomœa,* (also known as "Rabbit weed"). Perennial, creeping to a very great extent. Stems rooting at distant intervals. Leaves smooth, long petioled, two lobed, like those of *Bauhinia,* tipped with a *mucro.* Flowers large, reddish purple, very handsome. Common on the sandy beach north and south of Madras, where it is of great use in binding the loose sand, and in time rendering it sufficiently stable to bear grass. This fine creeper is equally abundant in both peninsulas, and is also a native of Mauritius, Macao, &c., occupying the place of *C. Soldanella* of the British coast, and we have rarely seen a more striking and beautiful species of the Tropical Bind weeds. Rabbits, goats, and horses eat it, so do cows, but

their milk is tainted. Great difficulty occurs in raising this plant in the vicinity of houses—as the inhabitants tread it down, and cattle nibble the tender shoots. It naturally takes a higher position on the sand-bank than the Spinifex, and suffers less injury during a storm, but they often grow together and conjointly effect much benefit. The Spinifex arrests the drifting sand, and the Ipomœa secures what the former collects. Mr. Cadell has planted it most extensively along the Canal banks near Tranquebar. (Plate No. 3).

3. *Canavalia obtusifolia* D. C. common on the sea-shore, frequently entwined with the last named binder, this is also a very useful plant, and is very abundant at the Adyar, Ennore, the mouth of the Godavery, and between Quilon and Anjengo. (Plate No. 4).

4. *Hydrophylax maritima*, Linn. Seaside *Hydrophylax*. A straggling herbaceous plant, native of the shore of Coromandel, where it shows its pale lilac blossoms great part of the year. The branches run over the sand, sometimes under the surface, and strike root at the joints. It answers well when the sand is moist. Figured in Roxb. Cor. pl. t. 233.

5. *Microrhynchus sarmentosus*, Wight. A widely diffused humble plant, common along the sea beach, with long flagelliform runners; but according to my observation, no species of the Compositæ possesses sufficient strength to effect the object in view. It is well figured in Wight's illustrations, Vol. II., t. 133. (Plate No. 5).

6. *Pupalia orbiculata*, Wight. *Achyranthes orbiculata*, Heyne, Wallich, *Cyathula orbiculata*, Moquin, "stem prostrate: leaves short petioled densely villous when young, becoming orbicular, retuse, acute at the base, smoother by age: fascicles densely tomentose, many-flowered, globular, remote, with long brown bristles." Wallich in Roxb. Fl. Ind. Carey Edit. 2. 507. Wight Icon. Vol. v. t. 1783.

On sandy soils near the sea beach, abundant at St. Thomé, and near the mouth of the Adyar River.

An extensively spreading procumbent plant, the branches being often several feet long, round, pubescent of a light brownish-green

colour: leaves when full-grown coriaceous and nearly glabrous, spikes terminal, long, at first compact, but becoming interrupted as the plant increases in length: fascicles of flowers capitate, densely tomentose: bristles when full-grown not simple, but compound, or as it were pinnate, pale brown, attaching themselves to the clothes of passengers, cling to them with tenacity.

7. *Pandanus odoratissimus*, Linn. (Kaldera bush.) A large spreading ramous shrub, which fringes the coast in many places, and is often planted in belts, but takes up much room, forms dense thickets, and harbours venomous reptiles. The lands in which Chay Root is cultivated are often protected from drift sand by means of this shrub. It is a *very strong binder*, but is objectionable from its raising sand-hills, which near the Marine Villa interrupted the currents of sea breeze to the island.

8. *Ehretia arenaria*, Griffith, which is found between 12° and 28° N. L. (*vide* "Notulæ ad plantas Asiaticas," Part IV, page 212) appears to be widely distributed, and binds together the loose sand, although in a minor degree. Is this the same as Ehretia (X) cuneata? Wight Icon. Vol. IV. t. 1385 which grows on sand banks in the beds of all our rivers.

The above are the sand-binding plants most frequently noticed along the Coromandel beach. There are others as *Pedalium murex*, *Ipomœa pes tigridis* and *Sesamum prostratum*, &c., which co-operate in the work of conservation to a minor extent, but are less widely diffused along the coast. In this notice, I have only included those which seem obviously preferable for the purpose specified, by peculiarity of structure or rapidity of growth.

List of Sand-binding Plants.

1. *Spinifex squarrosus*	Spinifex	Ravanan míse.
2. *Ipomœa pes capræ*	Goat's foot *Ipomœa*	Mosul taylie.
3. *Canavalia obtusifolia*	Round leaved *Canavalia*	Kòyli avaree.
4. *Hydrophylax maritima*	Seaside *Hydrophylax*.	
5. *Microrhynchus sarmentosus*	Creeping *Microrhyncus*.	
6. *Pupalia orbiculata*	Round leaved *Pupalia*.	Adai yotti.
7. *Pandanus odoratissimus*	Kaldera bush	Taylie marum.
8. *Ehretia arenaria*	Sand *Ehretia*	

Trees such as the Cashew (*Anacardium occidentale*) the Alexandrian Laurel (*Calophyllum Inophyllum*) and the wild Date (*Phœnix sylvestris*) grow well, and render a double service by preventing a further encroachment of sand, and rendering the land useful.

NOTE.—In support of my favorable opinion of the *Spinifex*, I may quote the following authorities from the Records of the Military Board.

In 1849, Major Worster, Superintendent of Roads, first recommended the transplantation of this grass as well adapted for securing the sand from drifting; and in 1851, he represented "that of the two experiments made with the *Rabbit Weed* and the *Ground Rattan* to protect the side of the Sea Beach Road, the preference is given to the Rattan, the trial of this plant to the extent of 872 ft. × 10 ft. being considered to have proved perfectly successful." Under these circumstances, Government sanctioned an outlay of 240 Rs. for planting the Ground Rattan between the Coom Bar and the Ice House, on a length of 4,109 feet by 12 in breadth.

Again, Captain Cannon, Acting Superintendent of Roads, under date 21st July 1853, in reporting on the effects of this plant in protecting the South Beach, states the experiment succeeded "as a preservative to the edges of the road next to the beach, preventing them from being breached to the same extent as formerly. The good effects are best seen (between the Marine Villa and fishermen's huts) by comparing the portions where it flourishes in full luxuriance, with those where from the constant passage of the fishermen over it, the plant has been destroyed: in the former there is a high bank of sand covered with vegetation, and little subject to drift, whereas in the latter, the sand is constantly shifting, and moreover the foot paths form channels for the drainage of the road, and where such is the case breaches most frequently occur. I consider the Ground Rattan far superior to the Rabbit Weed as a protection to the Beach."

Mr. Cadell, Sub Collector of Tanjore, likewise informs me that he finds this the hardiest and most useful of all the plants tried on the sides of the Eastern Coast Canal.

VII. *The Geological features of Madura, Trichinopoly, Tanjore, and Poothacotta. By the* REV. D. MUZZY.

The region of country embraced in this paper is that included in the four Districts of Madura, Trichinopoly, Tanjore and Poothacotta. It is bounded on the north by South Arcot and Salem, on the east by Paulk's Straits, on the south by the Gulf of Manar and the Collectorate of Tinnevelly, and on the west by the Province of Coimbatore and the Malabar country.

Its mountains are the Patchemalies or Green Mountains in the north-western part of Trichinopoly; the Pulneys and Serumalies in the Madura District, with various ranges of smaller mountains and detached spurs and cliffs, and some vast rocks. The rivers are the Vellàr, or White-river in the extreme north, the Cauvery and Vigay with their branches; these and a few other small streams comprise all the rivers that are found in this region.

The face of the country is that of a level, and in some places an undulating plain; lower in most cases at the foot of the mountains and vast rocks, which rise abruptly from the surface, than in other places. As most of the vallies are occupied with tanks and ponds for irrigating the country, ravines and deep water-courses are very few.

The soils are the regur, or black cotton in the north, west and south, and in small patches in some other places; the red sandy and red irony in parts of the Talooks of Sevagunga, Maloor, Ramgherry and Tadicomboo, and the light sandy and gravelly on the sea-shore and in vicinity of the rivers, and a few other places; and the dark-brown vegetable soil confined mostly to the hills and vallies of the mountains. These various soils, with the exception of the last mentioned, contain a portion of clay, but this is so free from it that water penetrates through it nearly as freely as through sand, or ashes, and when burned it falls to pieces like so much earth.

The alluvium beneath the soil partakes much of the nature of the underlaying rock except in the vicinity of the sea and the rivers. There it is either the fine-washed sand mingled with land, fresh water, or marine shells, or the fluviatile and lacustrine deposits. A deposit resembling the loess of the Rhone, and the silt and crag of some pools of England are met with in various places.

In noticing more particularly the features of this region we find, that in the northern part of the Trichinopoly District, in the black soil through which that remarkable bed of fossil shells and crustacea passes, and in the vicinity of the Vellár are beds of a pure basalt, both in nodular masses and in large blocks, and as it breaks with a smooth and even fracture, it is used, to a considerable extent, for building purposes. Adjoining this in the north-east are beds of laterite resting upon syenitic granite. And in the northwest the plains are much variegated by the out-croppings of this underlying granite, which in some places passes into syenite and greenstone, and rises in other places into hills and mountains that extend westward beyond the boundary of the District, and southward to within a few miles of the Cauvery. Among these hills is

a small mountain situated a few miles north-west of Moosery, composed partly of beautifully pure magnesite and brucite and some of the other magnesian compounds. Where it is associated with iron, it possesses considerable hardness and solidity, but the brucite is soft and friable and has a large proportion of magnesia in it.

Near this mountain, in the direction of Cannanore, is an extensive bed of pure chlorite potstone. This is wrought to a considerable extent, and the vessels made of it, find a ready sale in Trichinopoly, Madura and other large towns.

It is in this region also that portions of the iron ore used by the Porto Novo Iron Company are found. This appears to be an oxide of the metal occurring in small gravelly pieces in the soil and is mingled with much impurity.

In this vicinity, three miles from Moosery on the road to Salem, is situated a hill, or small mountain, composed, as far as appearances indicate, almost entirely of crystalline pyroxene associated with beds of albite. Here were masses of beautiful dark green crystals of jeffersonite, black cocolite, forsterite, and hypersthene. The disintegration of the pyroxene imparted to some places a peculiarly rusty and irony appearance.

At Totiem about eight miles from Moosery, the soil though composed of a large portion of sand, imbeds large quantities of felspathic gravel, which is used for improving the roads.

Near this place, is a ridge of rocks composed of a quartzose granite associated with striated siliceous limestone and pure albite, as also massive garnet and chlorite rock, and at a little distance were augite and felspar.

In the vicinity of the upper annicut on the Coleroon river are rocks of granular limestone, some of which have in their composition silica and pyroxene and some a portion of serpentine and the rock is a variety of verdantique marble.

To return again to the north, we find at Valcondapuram and vicinity considerable quantities of magnesian rocks. In some cases they are associated with lime and a chertty rock resembling a compound of jasper and lime. Beautifully pure specimens of magnesite as also round shot like grains or crystals of ferruginous oxide

of titanium in nodular concretions of recent limestone are found here.

The same kind of granite as mentioned above is found to underlie all this region to within about 10 miles of the Coleroon; in some places it is associated with the common granite as its frequent outcrop and disintegrating fragments in the soil plainly show. Nearly all the mountains and hills, however, and most of the vast blocks that nearly cover the surface in some places are syenitic. The granite near the river Coleroon is of the common kind and highly porphyritic.

At the junction of these two kinds of granite and crossing the road from Madras to Trichinopoly, near the 182nd mile stone from the former place, is a bed of finely and evenly stratified grey sandstone. The strata are from 2 or 3 inches to $\frac{1}{10}$th of an inch in thickness, and they separate with a fracture so smooth and even that the pieces resemble smooth plates of slate. A specimen obtained there is about 2 feet long, one foot wide and 1 inch thick and nearly as even and smooth as a board. The small crystals of felspar contained in it are of the orthaclase species, and of a dull flesh colour.

The extent of this bed has not been ascertained; it has been traced, however, more than a mile in length, but the width of the outcrop is not more than 10 or 15 yards; and it runs in a direction nearly east and west. The strata on the south side of the bed are crossed by joints which pass through it nearly parallel to each other and about two feet apart and at an angle of about 50° with the line of direction; the dip of the strata appeared to be about 60° on the south side and nearly 20° in the centre, while that of the north side was not satisfactorily determined. A singular characteristic of this bed is, that the strata on the south side of it are composed of nearly pure silicious sandstone; in the middle they were porphyritic, containing felspar, while those on the north side were composed almost entirely of a greenish black hornblende, these thin strata forming a beautiful hornblende slate. This appeared to be the junction of the two minerals hornblende and mica; to the north of this, hornblende, either in a free state, or combined

in syenitic granite, or greenstone, is prevalent, while to the south of it mica, combined with quartz and felspar forming the common or porphyritic granite, is equally prevalent.

We have now arrived in our notices of the country at the eastern part of the Trichinopoly District, which is traversed by that remarkable bed of fossil-shells already referred to, sometimes called the Ootatoor marble. In the tour mentioned above, this region was visited, and I proceed now to state a few particulars in regard to it.

In the vicinity of Ootatoor, the syenitic granite containing garnets is very abundant, it crops out and lies on the surface in flat masses and huge blocks; and rises into hills and mountains imbedding in some places the blue or oolitic quartz, fine specimens of jade, crocidolite, and a black curiously crystalline carbonate of lime and small pieces of iron.

About half a mile east of the Travellers' bungalow, the granite disappears from the surface, or remains only in small quantities and scattered in disintegrating fragments. The prospect from this place to the north, east and south is that of a great plain extending in vast wave-like undulations as far as the eye can reach..

The soil is a dark loam containing magnesia and lime evidently formed from the disintegration of the rock on or beneath its surface. Small pieces of red irony crystalline limestone as also pieces of the marble full of small white shells of the multilocular class called the turrilite are found here.

In the rolling surface of this plain, there is a fair opportunity, considering the loose and earthy nature of the soil, for the denuding effects of the water, hence we see many of those ridges worn into banks and mound-like and deep ravines by the torrents. One of these, about a mile east of the bungalow is well marked. The ravine is about 58 feet deep and lays bare the surrounding strata to a considerable extent. The upper stratum on the western side is a marl or earthy limestone and occupies a large portion of the surface; the next stratum below appeared to be an iron sandstone, slightly resembling laterite yet regularly stratified, and of a reddish brown color, evidently containing a considerable quantity of

the oxide of iron. Farther to the north where other smaller ravines come into the large one a still lower stratum is laid bare, it consists of a well-defined gneissoid sandstone. It is plainly and evenly stratified with layers of mica, silicious sand and felspar, or lime. The stone is soft and friable and appears to be considerably extensive, underlying much of the western part of this plain, its thickness is unknown. In a bank in the lower part of the ravine were strata of a pure white clay, or chalk alternating with layers of a dark dun-colored substance of the same apparent composition; both containing carbonic acid and effervescing freely with acids. This dun-colored clay is very extensive throughout this region and becomes indurated and passes into limestone. Much of the recent limestone in which the shells are imbedded is evidently formed from this clay; as it exists in different parts of this plain underlying the cotton soil in almost every degree of hardness from that of marl and soft clay to that of compact and solid limestone.

On the east side of this ravine, this clay and the cotton soil which commences here is overlaid with an earth containing salts of different kinds; those containing nitrate and muriate of soda are conspicuous. The sulphate of lime in the form of bladed, amorphous, and fibrous gypsum was so prevalent as nearly to cover the ground in some places although some bandy loads had been collected and sent to Madras. In and on the banks of this ravine were found a large number of the shells called belemnites and specimens of globular, cylindrical and over-shaped substances, of various sizes from that of an ounce bullet to that of some six or eight inches in diameter and length. These substances were composed invariably of a dark blood-red or brown-jointed oxide of iron and laterite or fine radiating zeolite. Sometimes these round substances were inclosed as nuclei in nodules of pure white chalk; but more frequently they were covered with a thin smooth cretaceous substance, which gave them an uniform appearance as far as the texture of this external coat was concerned.

In our farther examination of this interesting locality, it was found, that this black soil and these globular specimens of fossil crustacea, (as there is evidence to believe they are), extended to

nearly a mile east of the village of Giridimungalum, which is situated at the quarry of the Oottatoor shell marble, a distance of some five miles north easterly from Oottatoor.

As we passed from this place to Giridimungalum we saw, to the north of our path and some two or three miles from it, what had the appearance of vast banks and mounds of earth recently thrown up. On visiting them, however, we found them to be high ridges of land, washed into the forms mentioned, by torrents of water similar to the location just referred to. Here were found nearly all the different kinds of fossils and minerals that had been found there besides others, such as ammonites of some eight or ten different species, some of which though not entire, were more than nine inches in diameter and some entire were about six and seven inches, while others were only three or four inches, and nautili were well preserved and had the syphuncle well developed. While the fossil crustacea before referred to were here larger and more in the shape of the living animal, some resemble the body of a large lobster, or crab so exactly, that there seems but little risk in calling them fossils of that animal; and some resembled the different kinds of echinus, especially the spatangus. There were also other masses with two lobes somewhat resembling a small saddle having distinct marks of shell or skin. These are only a few of the great variety of forms and shapes that were met with. These were all composed of the oxide of iron, selenite, or zeolite and lime, as before described. Many of these bodies were broken and the oxide of iron, which had formed them, with portions of the fossil animal distinct, lay in different places where they had been entombed. They were of various sizes, from that of the shrimp to that of an animal of some 25 or 30 feet in length.

We next examined the limestone in the village of Giridimungalum; this appeared to be of different ages; while some of it, being highly crystalline, must have been of a high antiquity, other parts of it were more recent, imbedding a different kind of shell; and some appeared to be of the clay above mentioned, and to be, even now, in a state of formation. The shells in the oldest rock, were in the best state of preservation, being much fresher and freer from

fracture, than those in the more recent formation, some of them still retaining in part their color and all the small ridges natural to them. This rock is of a bluish color highly crystalline and so hard as to receive a good polish. A noticeable feature of these shells was, that although they were so numerous as to compose a large proportion of the rock, they were, with few exceptions, of the bivalve class.

Not possessing the means, nor the time to name these shells, I do not attempt it. Most of them will be found figured in Sowerby's Geological Conchology, in Lyell's Manual of Elementary Geology, and a few of them in this Journal for June 1840.

We obtained parts of what appeared to be two fossil tortoises and a few large bivalve shells entirely converted into limestone, a number of pieces of fossil wood in limestone; some with the holes made by the teredo nearly filled with calc spar; these also contain knots or the beginning of branches. There was also found at this place, an ammonite in good state of preservation measuring some 15 inches in diameter and about 4 inches in thickness; the outward whorl of which is partly free from the limestone which envelopes the central part and shows the shell but little altered. This bed of limestone was found to be narrow, not being more than half a mile wide in the widest place; we traced its length for about two miles south of the village and could see its outcrop for about a mile further. Persons were sent to follow this bed to its southern extremity, who returned with fossils and minerals; plainly indicating that although its continuous outcrop is not more than about four miles in length it does extend beneath the surface to the village of Pullumpardee near the Coleroon, where it again crops out and is wrought.

From the south of a small rivulet, which runs across it, the rock and fossils appeared to be more silicious, and frequent masses of granite and small pieces of sandstone were found among them. Now considering its extent from Pullumpardee, and that from the rise of ground near Giridimungalum those high denuded ridges, like those where the fossils are so numerous, can be seen extending in a north-easterly direction as far as the eye can reach, and also

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that this kind of limestone appears on and under the surface in the same direction at Virdachellum, Seedraput, and other places between these places, may we not safely conclude that this same formation accompanied by its fossils and minerals continues, either beneath, or upon the surface the whole distance from Seedraput to Pullumpardee? If so, we have a space of more than 100 miles in length and from two to five miles in breadth, which, when this country was submerged beneath the ocean, as was most probably the case in, what is called the cretaceous or latter part of the secondary epoch, was the peculiar home and feeding ground of innumerable animals, similar to what the Newfoundland and Bahama banks are now. Here, they lived and flourished and here they died and were buried, and here in the abundance of their fossil remains we read the history of creative wisdom and preserving goodness of which we have such abundant evidence in our day.

In our return to Trichinopoly we found the country near Oottatoor covered, in places with the same dark granite before mentioned, and across the road passed a vein of pure augite slate, so hard and fine grained as to admit of a high polish. At the distance of about three miles south-west from Oottatoor occurred the same undulating denuded surface as at Giridimungalum in which were found nodular concretions of iron ochre imbedding selenite which was very pure; here was also found chlorite, porphyry and an abundance of crystalline gypsum and a kind of limestone which had the appearance of being simply a mass of fossil hamites, and another kind made up of different species of the shell called terabratula, the turbinidœ, and many others; the whole differing entirely from any thing discovered in the other places mentioned. This is an interesting locality and deserves further investigation.

As the formation on the sea-shore and in the vicinity of the rivers is composed of light sand, and up from the shore, of diluvium brought down by the waters, it will require no further remark.

We have now come to the northern part of the Madura District. We find that granite underlies nearly the whole of this District; there is reason to believe that the laterite rests upon granite, as it

does in other places. So also some of the syenite on the tops of the mountains is found to rest upon granite. Indeed syenite is not known to be an underlying rock to any extent in any part of this district, but appears in blocks or rounded masses both on the mountains and some parts of the plains.

In the direction of Vellum and Poothacotta from Trichinopoly the granite pierces the laterite, which covers most of the surface, in a number of places where it appears either in ridges of some height or in broken masses scattered over the plains, but the laterite does not appear here often in the form of a rock, but of gravel mingled with the soil, or immediately beneath it. In the vicinity of Vellum and from that place south through the Poothacotta and Sivagunga districts, the laterite takes more the form of a glomerate rock and is used for building purposes. Its appearance in some places when it is forming is that of a liquid percolating the soil and forming for itself small pipes, or veins which branch in different directions not unlike the veins in the human system; these multiply and harden till the whole mass becomes thoroughly impregnated with iron, and by degrees formed into a hard and rich iron ore. Considerable hills are formed of this substance in the Poothacotta district; still containing the pipe, or vein-like formation.

From Trichinopoly in a south and south-westerly direction the granite is porphyritic and contains at Verallimalli a vein of nodular greenstone imbedding granular chlorite and beautifully white albite. On the road from Trichinopoly to Dindigul at Amaparthi is a bed of granular limestone imbedding grains of pyroxene, of considerable extent and hardness; this is found in some cases united to the granite, connected with the felspar of which, are crystals of vermicutorite. At Manaparie 25 miles south-west from Trichinopoly, the granite is diversified by large masses of viscid quartz and quartz rock and granite; the minerals found at this place are rock crystals, axinite, calcspar, chlorite, ripidolite, octahedral and specular iron, prehnite, chlorite porphyry, polyolite, schorl, albite, pyrope, garnet, aquamarine, nigrin, rutile, zeuxite, arseniate of copper, nicoline, and crystalline hornblende.

Near Corttamperthe is an extensive bed of silicate of iron; it forms a part of four small mountains and continues in one direc-

tion, either upon, or beneath the surface, a distance of about eight miles and contains the different varieties of this ore and their different crystals.

In the vicinity of Tovarankurchy are considerable hills of quartz rock having a quantity of green diallage in its composition. In the Maloane mountains, gonulite is the prevalent rock and it imbeds black and common garnets which with the massive variety is found in considerable quantities in the granite soil of this region. Alagiri Malei is a mountain situated 12 miles north of Madura and is about 1,000 feet in height and some ten or fifteen miles in length, and is composed almost entirely of aventurine quartz or micaceous sandstone. Some portions of it appear to have been formed upon a shore and are stratified and have inequalities resembling ripple-marks.

Five miles north-east from Madura is that remarkable rock called Elephant mountain, from its resemblance to that animal in a reclining posture. It is a block of gneiss two miles in length, $\frac{1}{4}$ of a mile wide and some 250 feet high. Strata of felspar, mica, and quartz run horizontally through this mass from one end to the other and are seen on both sides of it, and are crossed at different angles by veins or faults of a felspathic rock which pass through the entire vein. A porch and a temple have been hewn out of one side of it. As there can be but little doubt of the sedimentary origin of this rock, we must suppose it to have been formed in some vast pit and elevated to its present position by that force which has produced so many of the changes which have from time to time variegated the surface of the earth.

The vast fields of granite at the south-eastern base of the Sirumalei and Alagiri mountains would seem to indicate the direction and denuding force of ancient oceanic currents.

At Vadapadi 16 miles north-west from Madura is a small mountain composed almost entirely of porphyritic greenstone. The hornblende in its composition is of the dark basaltic variety and the felspar is of the andesine or the white variety and in the composition of the mass the columns appear in spots like the skin of a Leopard.

The limestones of the district are numerous and of various kinds. The lime gravel, or kunker, is widely diffused in the soil, and in some places is nearly a pure carbonate of lime ; in other places it is mingled with other substances and takes the form and consistence of concreted limestone or pisolite. These are the kinds used for making roads and burning into lime. Travertine or tufa is found in stalagmitic concretions in caves and bordering around the stems and branches of plants. The crystalline limestones are also numerous, they are found in nodular masses and large blocks and show the crystals of calcspar and the fine granular and compact varieties. Some of these kinds receive a tolerably good polish and might, it is thought, be wrought for marble. The minerals found imbedded in these stones are the chondrodite, graphite, pyroxene, and molybdenum ; and the different locations where they are found are Poovandy, Puntelacoodee, Carnapadi, Vitherapadi, in the Tirumungalum Talook and in a number of other places. In the location at Puntelacoodee the outcrop is some 20 yards in width, six or five miles long and of a depth not explored. These masses of rocks are nodular in most places, nor does there appear to be any regularity of dip in the case of any of them. They lie in wild confusion in every part of these limits resembling the ruin of a vast wall. The stone of the south side of this bed is highly crystalline calcspar of a dull whitish colour, while that on the north side is finely granular or compact, and of a bright flesh colour.

Another feature of the district is its iron. This is widely diffused : it is found in almost every part of the district, either in the form of native iron or united with oxide in the form of hæmatite, of ochre or of octahedral crystals of specular iron and iron sand, &c. ; there is the silicate of iron, the carbonate and sulphuret and a vast quantity of laterite, but so small quantities are found in any one place, except of the silicate and laterite that it has been but little wrought.

The region where gold is sometimes found was visited and the sand and rocks of the same, to some extent, examined. The name of the place is Pulkanáth, 14 miles north of Dindigul just under the east end of the Pulney mountains. The gold is found in small

particles in the alluvium and sand of a plain at the foot of a small mountain about two miles from the Travellers' bungalow. The soil and alluvium of this plain are composed of the disintegrated and decomposed rocks of the mountain, as the frequent fragments, and sand and gravel abundantly testify. So that there is no doubt, but that the gold was originally in this rock which is in some places a granulitic, in some a micaceous, and in others a syenitic granite containing alamandine garnets and specular iron in abundance. The yield of gold as yet obtained is rather small, not averaging more in value than could be earned by day labor. This is probably owing, partly to the inefficient way the labor is performed, and partly to a want of water: it is the opinion of those who have taken gold here that the proportion of gold is much larger at the depth of some feet below the soil than on the surface. Could a shaft be sunk some 25 or 30 feet, there is a fair prospect that the yield would well repay the labor, especially as it would afford water to wash the earth and sand, which is now found only at a considerable distance from the place where it could be used.

VIII. *A Vocabulary of the Dialect spoken by the* TODAS *of the* NILAGIRI *mountains. By the Rev.* F. METZ *of the German Evangelical Mission.*

[Previous notices have appeared in this Journal, descriptive of the manners and customs of this peculiar race, the Todas. Vide an article entitled, "The antiquities of the Neilgherry Hills, including an inquiry into the de-" scent of the Thautawars or Todars. By Captain *H. Congreve*." Vol. XIV. No. 32, 1847. See also "An Essay on the Relationship of Languages and "Nations. By the Rev. *Bernhard Schmid*," Vol. V. No. 14, 1837. But nothing like an useful Vocabulary of the Toda language has yet been published. ED. M. JOUR.]

The pectoral pronunciation of the Todas in speaking their language is the reason why so many Europeans, who heard them speak, believed that it had no relationship at all with any of the S. Indian languages. If these Europeans had lived longer among the Todas and if they had understood the Badaga dialect, they could not have given such an opinion. In my opinion the Toda language is a rude dialect of old Canarese and I can find nearly all its words in the Badaga language, only I must keep in mind, that according to the rules of Toda pronunciation a common Canarese word is so much changed that it is difficult to recognize it again as such and it requires a long time to get the ear accustomed to their jungle language. I find it nearly impossible to get their language reduced to writing with such perfection, that any one who reads my Toda words can be understood by the Todas. On this account I may say, that the Toda language cannot be properly learned except by living amongst the Todas and by hearing their conversations.

As the whole life of a Toda is concentrated in his Buffaloes and as no great variety of words is required for the purposes

of their common life and occupation, I find it very difficult to discover words for abstract terms, without which I cannot have a religious conversation with them, so I help myself with Badaga words, which most of them understand. The Todas do not trouble themselves much about religion. Theirs is a very convenient one. Heaven is nothing else but a place where they will have plenty of Buffaloes and as no Toda has any doubt about his going to heaven, he thinks that the occupation in the other world viz. feeding Buffaloes does not require any preparation.

On this account I find their language very poor and insufficient to convey the truth of the Gospel to them.

Most of their verbs have only one tense, and they help themselves by adverbs of time to express the future and past tenses.

I also find that there is a slight difference in the dialects of the different tribes of the Todas. For instance one tribe has an *Sh* where another has an *S* or a *Th* (like the English,) which another again changes into *S* or *T*. I write their language in Canarese characters. In printing the Gospel of Luke in the Badaga language, we were obliged to take up some of the old Canarese characters, which are not in use now in the present Canarese. In the Toda language I helped myself by adding marks in some characters to shew the peculiar Toda sound. For instance, the *Th* I have given with ಥ to distinguish it from ಥ, and as their *Kh* is pronounced like the German or rather Swiss *Ch* I mark this sound by ಖ to make it different from ಖ. In many cases the *Ph* is like the English *F*, which

no Badaga can pronounce on account of the pectoral pronunciation, I have therefore chosen ఫ to represent (*F.*) They have no pure *A* as it occurs in other Indian languages but their *ā* is pronounced as *ā* in tāll and as *u* in much.

There are 2 sounds of the vowel *i* (ee) the one is like the English *ee* (*í*) in meet, the other one like the German *ü* in *über*, for instance, బ ష్ర *birsh* with *ü* means a tiger and బీష్ర *bírsh* with *ee* means the sun, మ ష్ర *mirsh* with *ü* means a hare and మీష్ర *mírsh* with *í* means a peacock.

VOCABULARY.

Abaisance (I make) కాల్ మేలెబుత్థ్ బిని *kál-méle-butth-bini.*

I fall at (your) foot.

Abandon బుట్టు బుత్థ్ బిని *butt'hu-butth-bini.* Badaga బుట్టు బుట్టినే. *butt'hu butt'hini.*

Abide ఎష్ కెన్ *eshken* lit. I sit ఎష్ కేనా shall I sit down.

Abject తలి వెర్ష్ బిని *tali vershbini; ersbini, ershbini* or *vershbini* means I am, which is generally put to the root of a verb. The Badagas use *unnane* (ఉంనానే.) for it.

Abominate నాంథ్ బిని. *nánth bini.*

Abomination నానం. *nánam.*

Abortion మొఖ్ యిడిలాడి. *mokh yidiládi.*

Absorb నుగ్గివిట్టిని *nuggivitt'hini,** Badaga నుంగివిట్టినే.

Absurd పెరాత్. *perát.*

Abundant ఉపాం. *upám.*

Accede ఆడ్బిని. *ádbini.*

* The Todas always assimilate the *n* to the following consonant.

Accept పర్థ్ బిని. *parth bini.*

Accommodate సరిమాడ్థ్ బిని, సరిగిత్థ్ బిని.

sari máḍthbini sariyiṭṭhbini. B. *sari máḍine, sari giṭṭine.*

Account v. యెనివెర్ష్ బిని. *yenivershbini.* B. *yeniuṇṇane.*

Account n. యెక్కం. *yekkam.* B. *yekka.*

Accompany కూత్థ్ వెర్ష్ బిని. *kúṭth vershbini.*

B. *kúṭiuṇṇane.*

Accurate సరి. *sari.* B. *sarri.*

Accurse బర్తిబడ్థ్ బిని. *bartibadthbini.*

Accuse పిర్యాది యెష్ట్స్ బిని. *piryádi yeshts bini.*

Aches, it బాద్థ్ తి, పస్తి or పరస్తి. *Bádthati, pasti* or *parasti.*

Acquire కత్థ్ బిని, *katthbini.* B. *kattiuṇṇane.*

Adolescence మొఖర్ష్. *mokharsh.*

Adore కుబ్బుట్టిఖెన్, అడబుద్థిఖెన్. *kubbuṭṭ'hikhen,*

aḍabudthikhen. B. *kombiṭṭine,** *aḍabuddini* I bow down the horn, I fall.

Adorn నార్షిమాడ్థ్ బిని, నార్ష్ గెర్ష్ బిని.

nárshi máḍth bini, nársh gersh bini.

Adultery ఉర్ద్థ్ వెర్ష్ బిని, సూళె బచ్ వెర్ష్ బిని.

urdthvershbini, súḷe bach versh bini. I commit a.

Adulterer సూళెమొఖ్. *súḷe mokh.* B. *súḷemaga.*

Advantage ఉలివల్. *ulival.*

Adversary అఖెవెర్ష్ బేన్. *Akhevershbén.*

Advice బిద్ది. *biddi.*† B. *buddi.* (wisdom.)

* This appears rather to be a corruption of the Tamil கும்பிட்டேன் *kumbiṭṭén* I salute.—W. E.

† The *i* in బిద్ది is pronounced like the German *ü* in *über.*

Afar బథ్ఖ్. *bathakh.*

Affection గవ. *gava.* B. *gáva.*

Afraid అజ్జ్స్బిని. *ajjsbini.* B. *anjine.*

Afternoon ఏకార వొత్ఖ్. *ékára vótkh.*

Again తెరిగి. *terigi* B. *tirigi.*

Age ప్రేయ. *préya.* B. *perea.*

Ago ముచ్ఛ్. *muchch.* B. *munche.*

Agree వొబ్బిస్బిని *vobbisbini* B. *vobbiuṇṇane.*

Air, wind కాత్. *kát.* B. *kātu.*

Alas అయాఖ్. *ayákh.*

Alms దర్మ. *Darma* B. *darma.*

Alike ఉద్థేర్ష్బిని. *udthérshbini.*

All యెల్లుమాడి. *yellumadi.* B. *yella.*

Anecdote కధ్. *kadh* B. *kade.*

Alone ఉద్దియాళాడి. *uddiaḷádi.* B. *vondāḷági.*

Amputate క్వర్థ్దెర్ష్బిని. *kwarthdershbini.*

Anger బిజ. *bija.*

Angry I am బిజబద్థ్చి *bija badthachi* (anger is come)

Ana వెలి. *veli.*

Ancestor దొడ్డావన్. *doḍḍavan.*

Another యింనొడ్డ్. *yinnodd.*

Ant ఎర్బ్ *yerb.* white ant గెజలు. *gèjalu.*

Ant hill — గెజలుత్త. *gejalutta.*

Ape — తూరున్. *túrun.*

Appear — తూవర్స్బిని. *túvarsbini.*

Arbiter — నాయగారన్. *náyagáran.*

Arm — పార్. *par.*

Apprehend — బత్తివెర్ష్బిని. *battivershbini.*

Army — దడ్డు. *daḍḍu.*

Arrive బష్కెన్. *bashken.* బడ్డ్స్బిని. *baddsbini.*

Arise మగెదడు వెర్ష్బిని. *magedadu vershbini, imperative* మగ్లోయ్. *irregular.*

Arrow — ఆబు. *ábu.*

Around — తుచి. *tuchi.*

Arse — తుదర్ష్. *tudarsh.*

Ascend — హత్స్బిని. *hatsbini.*

Ashamed — నాంథ్బిని. *nánthbini.*

Assembly — కూట. *kúṭa.*

Assemble — కూటగెర్ష్బిని. *kuṭagershbini.*

Ass — క్వత్తె. *kwatte.*

Attend — క్వేడ్స్బిని. *kwéḍsbini.*

Attest — సాకిసియెర్ష్బిని. *sákisiershbini.*

Avarice — కరి. *kari.*

Avidity — ఆశె. *áse.*

Authority — అధికారం. *adikáram.*

IX. *Scientific Intelligence.*

[The following letters regarding Earthquakes, lately observed at Travancore, are extracted from the Madras *Athenæum.*]

SIR,—Perhaps the following account of the Earthquake observed in Travancore on the morning of Monday the 11th instant may interest some of your readers.

The assistant in the Trevandrum observatory having the watch on the morning referred to, was entering an observation when he heard a low rumbling sound which he thought at first was distant thunder towards the north-east; in about three seconds the rafters of the building began to creak, the windows to rattle and a mirror resting on the table to shake: he immediately looked at the clock and found the time 5 h. 53 m. 30 s. which, allowing for the known clock error, would give the mean Trevandrum time of the commencement of the sound 5 h. 51 m. 25 s. He then went out to look towards the north-east and immediately thereafter the sound ceased with a louder "bom"; on looking again at the clock the time by it was 5 h. 54 m. and he estimated the duration of noise and shock at nearly twenty seconds. He now examined the magnetical instruments, but could perceive neither vibration nor change of mean position. It is not impossible however that the magnets might have had swinging or dancing motions without being remarked by the observer, as vibrations round a vertical axis only are noted. An examination by myself since, of the observations made before and after the shock, confirms the fact of the steadiness of all the magnets; neither did I find any thing remarkable in the state of the atmosphere. The velocity of the wind from the north-west was nearly as usual at the same hour; the sky was nine-tenths clouded, the clouds moving from north-west; the temperature of the air was nearly 73°, the maximum temperature of the day being nearly 78°.

A lady living near the observatory was awoke by a low rumbling, puffing noise, which terminated by a stifled explosion, as if under

ground, she saw the foot of the bed moving slightly from side to side (north and south) and heard the windows rattle. The sound seemed to her to precede the shaking by a few seconds, but she did not conceive that the whole lasted more than from five to ten seconds. The air appeared hazy to her and to several other persons. The atmosphere felt close and disagreeable during the day.

Lieutenant Colonel Faunce, living about three-quarters of a mile west of the observatory, has informed me, that the noise and shock appeared to him to come from the south-east and to proceed in a north-westerly direction: the noise seemed in or on the surface of the ground and the noise and shock lasted at least six or seven seconds. The shock was rather strong, his right leg was swayed from right to left (i. e. east to west) while he was sitting facing the north and his whole body felt the movement: Colonel Faunce also thinks that the sound preceded the shock. The windows rattled considerably. He likened the noise to that of a steam carriage; a rumbling sound terminating louder than it commenced.

Dr. Sperschneider, three-quarters of a mile north-west of the observatory, also felt the shock. The noise he says began a few seconds before the earthquake and lasted a few seconds after it. It appeared to Dr. Sperschneider to go off in a westerly or north-westerly direction; the windows and roof of his house trembled.

Dr. Waring, about a mile and half north of the observatory, heard and felt the earthquake though apparently not so markedly as by the others. I am told that about the same distance south south-east of the observatory the shock was very distant; while within the fort about two miles south of the observatory the earthquake was not perceived at all. It should be noted that about the Fort decomposed granitic rocks are covered by a thick stratum of sand, while all the other stations are immediately on laterite rock.

The shock it seems was felt at Quilon "about six o'clock," and Mr. Liddell at Charlio's Hope near the road between Quilon and Courtallum says "we had a smart shock of an earthquake about ten minutes before six on Monday morning."

I was on the summit of our highest mountains, the Agusteer Mally (about 30 miles W. N. W. of Trevandrum) on Monday the 11th but did not perceive any shock. I noted that the Tinnevelly country and the mountains to the north appeared much clearer that morning than usual.

The testimony on the whole seems to indicate a southerly and easterly point as the direction of the origin, all agree that the sound was heard before the shock was perceived.

It is quite possible that the shock may have been propagated from Tinnevelly below the ghats and not have been very sensible at their summits. It would be of importance for the purpose of determining the origin, the velocities and the direction of transmission of the shock to have the accurate time it was perceived at some localities considerably distant from Trevandrum.

I have the honor to be,

Sir,

Your's obediently,

JOHN ALLAN BROWN.

Trevandrum Observatory,
16th August, 1856.

P. S.—Where the earthquake has been observed it will be desirable to mention by what means the error of the timepiece has been obtained.

SIR,—I took the liberty a few days ago of forwarding to you a notice of an earthquake felt in Travancore on the 11th instant, allow me to add to that communication that I have found since that the shock was neither perceived at Nagercoil (40 miles S. E. by E. of Trevandrum) nor at Cochin (120 miles N. W. by N.) but I understand it was felt at Cottyam (90 miles N. N. W.) It was also felt at Courtallum (40 miles N. E.) by several persons; and Dr. Barker estimates the time of the shock there at 5h. 50m. A. M. (verified to some degree by the sunrise) this time agrees really with that of the shock at Trevandrum. At Quilon Mr. D'Albedhyll informs me that two ladies give 20 minutes before 6 as the time of

the shock. On the best consideration of all the facts as yet received by me I am inclined to consider a west north-westerly direction from Trevandrum as that of the origin of the shock and perhaps towards the Laccadive islands.

On the 22nd August about 4 hour 25 minutes P. M. while lying on a cot reading in an upper room I felt the cot shaking rather violently, I immediately looked at the bed posts, these, and the tester frame seemed to vibrate irregularly and sharply from east to west. On going to the magnetic observatory I found the time of the shock to have been almost exactly 4 hours 25 minutes, 10 seconds. I observed the magnets dancing up and down in short jerks, and a brass weight hanging in a closed box was observed by means of a telescope, to dance perceptibly 15 *minutes* after the shock. I could not observe any swag or side motion, but I concluded from the vibration of a hanging cord, seen in a room below me by another person, from the motion of the bed posts, and from the wetted sides of a glass vessel containing water, that the shock had been propagated in the direction between W. N. W. and E. S. E. the shock was accompanied by a low trembling sound. This second shock was observed also at Quilon by Mr. D'Albedhyll and others about 4h. 16 minutes. If the clocks there can be trusted this, as in the case of the first shock, is about 10 minutes before the time at Trevandrum.

General Cullen informs me that a shock was felt in Travancore in February 1823, 19th September 1841 and 20th November 1845.

I shall feel obliged, if any person has observed the time or direction of either of the shocks of the present month, by the communication of the facts to me.

I have the honor to be,

Sir,

Yours faithfully,

JOHN ALLAN BROWN.

Trevandrum, 25th August, 1856.

P. S.—The second shock is said to have been stronger than the first. The first shock was observed at Quilon by few persons; the second was observed by many Europeans and Natives. No native

at Trevandrum appears to have observed either shock excepting those on the watch at the observatory.

SIR,—The shocks of earthquake are reaching us so frequently that they will cease to be interesting as news, and the proper place to notice them in detail will be in the pages of some scientific periodical.

Another shock was felt here at 15 m. 0 s. afternoon of to-day (1st September). The effects of the shock on the magnetical instruments were even more remarkable than on the last occasion; and the ball of a pendulum 17 feet long moved through a space of about 4 inches in the direction N. W. by N. and S. E. by S.; I believe from the former to the latter.

In my attempts to obtain information on the last two shocks I have heard (from Dr. Colebrook of Madura) of a remarkable shock experienced on the 17th of March last, near midnight, about 30 to 40 miles east of Madura, the noise seeming to travel from west to east. An examination of the observations of the magnetical instruments in observatories on Agustier Mullay and here, shows that the shock was felt markedly by both places.

Any communication on earthquake shocks felt in Southern India addressed to me would much oblige.

Sir,

Your's very obediently,

JOHN ALLAN BROWN.

Trevandrum, 1st September, 1856.

[The following letter, describing the shock experienced on the 17th of March last in Madura, is taken from the "*Thinavarthamani*" of the 27th March 1856, a Tamul Newspaper edited by the Rev. P. PERCIVAL.]

(Literally translated.)

"I am sure you will not object to publish the following account of a wonderful Phenomenon, in your valuable journal, for the information of the people of other countries.

At 1 o'clock on the night of the 17th March 1856, a sound was suddenly heard in Paramagoody a village of this Zillah of Madura,

which continued 10 minutes like a peal of thunder, and appeared to move from west to east. During its continuance houses and other things were agitated, and many persons who were sleeping were aroused and sprung from their beds.

Fissures in the earth were also caused in some places.

The people of this village, ignorant of the nature of this phenomenon, feared that it might be a judgment inflicted by the Gods.

Since that, the Moonsiff of this Division, Mr. William Boalth, has told them that it was an earthquake, and has explained its cause and mentioned other incidents of a similar kind; which has proved a relief to their minds. I think your readers will not be otherwise than wonderstruck at this occurrence."

I am,

Your servant,

THEROO CANACASABY MODILIAR.

Paramagoody,
20th March, 1856.

[Extract of a letter from R. D. PARKER, Collector of Madura, dated 31th of August 1856, reporting the discovery of a pot of gold coins in his district].

" In a piece of waste land, belonging to the village of Caliempootoor, in the Iyempully Talook, a pot of very beautiful gold coins, bearing the heads of Augustus and other early Roman Emperors, has been discovered.

The persons Pona Boyen and Dasa Boyen by whom they were found, and who are tank diggers, were employed in excavating brick earth. The coins were packed in an earthen pot about the size of a large mango, which unfortunately is broken. The original No. was 63, of which 4 are not forthcoming and two are reduced to ingots, leaving 57 in excellent preservation, with the heads and inscriptions exceedingly distinct. The pot was found about $\frac{1}{2}$ foot below the surface of the ground adjacent to the bank of the Shunmoogum Nuddy River, which is near the boundary of the Madura and Coimbatore Districts, and rather more than 30 miles South-West of Dindigul."

[The following notice of the late Storm of the 20th Nov. 1856, was kindly furnished by Major JACOB, The Hon'ble Company's Astronomer.]

The Barometer began to show a downward tendency as early as the night of the 17th but so slight as to cause no alarm; for the next two days this tendency continued, but there was no sudden depression; the daily rise being only a little *less*, and the daily fall rather *more* prolonged than usual. No decided fall took place until the afternoon of the 20th when instead of the usual rise after 4. P. M., the mercury, after fluctuating slightly for about an hour, continued descending until 3 h. 30 m. A. M. on 21st, when it stood at 29·540.

The wind, which had been for some days a little westerly, blue rather fresh from N. N. W. about midnight of the 19th, but the pressure scarcely exceeded 5lb. on the square foot.

On the morning of the 20th, after a short lull it veered to the eastward of N., about 10 h. 30 A. M. returning to nearly due N., in the afternoon between 2 and 3 P. M. the pressure reached 12lb. but only in a single gust. From 5 to 8 the gale moderated and again became easterly; but freshened again during the night, and about midnight began to veer westerly, from 4 to 5 A. M. on the 21st it attained a force of 18½ lb., when it began gradually to moderate and by the evening had become nearly calm, still coming round till it finally blew S. W. The Barometer continued to rise steadily from 3½ A. M., and by the evening had nearly attained its usual height.

From the course followed by the wind it was inferred that the centre of the storm was passing a little southward of Madras, and this agrees with the reports of the shipping which stood out to sea in a S. E. direction, and met with worse weather than what occurred on shore.

The rain continued heavily on the evening of the 19th, and continued with little intermission until the morning of the 21st, the fall in those 36 hours amounting to 11·65 in. of which 6·22 in. fell in the night of the 20th.

X. *Proceedings of the Madras Literary Society and Auxiliary of the Royal Asiatic Society.*

Thursday Evening, October 9, 1856.

The Hon'ble WALTER ELLIOT, President, in the chair. Read extract of a letter from H. CLEGHORN Esq., M. D., dated 11th September 1856.

I take this opportunity of submitting for the consideration of the Committee, some passing thoughts as to the urgent want of a good Library of reference in Madras, a want equally felt, I believe, in the other Presidency Towns of India. The advance of education and the increased attention bestowed upon Statistical and Scientific enquiries, renders the possession of standard works for reference an imperative necessity. The arrival of many able men in India, who have devoted much time and attention to particular branches of science has greatly increased the demand for books, and the supply has to a certain extent kept place with the demand; but still there is no place in Madras where a student can find the information required in many enquiries of every day occurrence. Standard works on many branches of science are with difficulty obtained for reference. The Medical College and Medical Society having formed their books into one collection, the aggregate exhibits a fair professional Library. The Corps of Engineers and Artillery have each a good well selected Library relating to their respective Departments. The Clerical Society has I believe a Theological Depôt. At the Club House there is a considerable collection of works upon Miscellaneous Literature. The Literary Society alone has a large General Library containing (crowded together in a small area and scarcely in a consultable state) almost all the more interesting works of Travels, History, Science, and Antiquity, but the Society like the sister in Calcutta has almost ceased to purchase the more expensive publications of the day, and by necessity devotes the greater portion of its fluctuating income to works of an ephemeral nature, because they are in special demand by the bulk of Subscribers, while the Chemist, the Naturalist, the Archœologist, and the Statist have no means of keeping up to the level of the day, and have no means of knowing the discoveries which have been and are being recorded, unless they are able and willing to purchase largely from their own resources, and there are few who are in a position to do this.

Resolved, with reference to Dr. Cleghorn's letter, that 10 per cent. of the Society's funds be set apart for the purchase of standard works on scientific subjects.

The Secretary communicated to the Meeting, the result of a Circular issued in May last, and forwarded to all the Stations in the

Interior, inviting Contributions and Subscriptions in support of the "Madras Journal of Literature and Science," the Society having determined to commence the republication of that Journal. The appeal for literary support having been responded to with much readiness and upwards of 200 Subscribers having been registered, it was *resolved*, on the motion of the President, seconded by Mr. G. Ellis, that the Journal be published Quarterly, and that the number for October, November, December 1856, be entitled No.* I. of a "New Series," and be issued in December.

The foregoing resolution having been discussed and agreed to; it was resolved to refer the same to a Committee of Papers to carry the resolution into effect.

Read an interesting paper by George Smith, M. D., Residency Surgeon, Hyderabad, descriptive of the Natron Lake of Loonar, in the Deccan, accompanied by a plan and section of the Lake, with two statements exhibiting the result of two experiments to extract Salt from the Lake.

Read also an excellent account, by the same gentleman, of the Manufacture of Bidderyware, at Beder.

Read also a paper on Indian Currencies by J. W. Breeks, M. C. Service; and a paper descriptive of the Plain or Waxed Paper Process in Photography, by Jesse Mitchell, Adjt. 1st Nat. Vet. Battalion.

Resolved, that the thanks of the Society be presented to the Donors and that the Papers be set aside for publication in the Journal.

The thanks of the Society were voted to Major Jacob, Director of the Madras Observatory, for the Meteorological Observations for July, August and September last, which will appear in the Journal.

Thursday Evening, November 13, 1856.

The Hon'ble WALTER ELLIOT, President, in the Chair.

The Secretary informed the Meeting that specimens of Salt, extracted from the Loonar Lake, had been forwarded to Dr. Mayer, Professor of Chemistry, Madras, for examination.

* No. II. of "New Series" for January, February and March 1857, will be published in March.

Dr. Mayer's Report was laid upon the Table:

Read the following letter from Dr. Mayer,

I have much pleasure in forwarding the accompanying paper on the Chemical composition, properties, and probable uses of the various Salts forwarded to me, and stated to be obtained from the Loonar Lake. I cannot close this note without favorable mention of Mr. G. Norton my assistant in the Laboratory, by whose great assiduity and intelligence I have been enabled to finish my examination in a very short space of time.

Resolved, to tender the thanks of the Society to Dr. Mayer for his able and interesting Report, which was delivered to the Committee of Papers for publication in the Journal, as an appendix to Dr. Smith's account of the Loonar Lake.

The Receipt of the following Papers, was communicated to the Meeting.

A Vocabulary of the Toda Language, by the Rev. T. Metz, of the German Evangelical Mission, (commenced in the present number.)

An Entomological Paper descriptive of some new Coleoptera found at Ceylon, by J. Nietner Esq., (published in the present number.)

This is the first number of a Series of Entomological papers, which the author has resolved upon publishing. He has kindly promised to furnish the Society with a fresh number every month.

The thanks of the Society were voted to Mr. Metz and Mr. Nietner for their able communications, and the Committee of Papers were desired to address a letter to the latter gentleman to inform him of the pleasure it will afford the Society to receive a fresh Entomological paper from him every month.

The following papers were presented to the Meeting.

The Secretary to the Photographic Society communicated a paper by Captain Tripe on a Paper Process which he has found well suited to Indian Photography. This paper, which had already been read before the Photographic Society, will appear in the Journal, together with a table of Formulæ for preparing Albumenized paper, drawn up by Captain Scott of the Artillery, also transmitted by the Secretary.

Mr. Elliot read a paper, communicated through him by Dr. Traill, on a collection of deep sea Molluscs made with the aid of a tow-

ing net, on his voyage from England round the Cape in the American Clipper *Blue Jacket.* Mr. Traill is known as an accomplished Malacologist. During the former period of his service he successfully investigated the Conchology of the Straits, and since his return to India he has classified and named the shells in the Government Central Museum. The paper was accompanied by drawings of the different species obtained during the voyage and by a chart exhibiting the localities at which they were captured.

After some general observations on the classification of Pelagian Shells and on the means employed for catching them, Mr. Traill proceeds to notice the different specimens, in the order in which they were found, giving incidentally such notices of their peculiar habits and forms as occurred to him, and referring to the figures. It is to be regretted that he has not added a synoptical descriptive list of all the species, naming such as have not been hitherto described. This desideratum, it is hoped, may still be supplied.

The specimens more particularly noticed in the paper belong to the division of ENCEPHALOUS MOLLUSCS, and include examples of all the great families, the PTEROPODS, GASTEROPODS and CEPHALOPODS, by far the largest number appertaining to the first, which are essentially oceanic in their habits.

Of the CEPHALOPODS a single species only was obtained of a diminutive *Argonaut* apparently new to Science, of which two specimens were captured alive. Mr. Traill gives an interesting description of its locomotive habits and shows that it differs from the common Paper Nautilus.

Individuals were captured belonging to two genera of GASTROPODS, viz. three species of *Ianthina* and two of *Atalanta.* The Author remarks on the singular fact of finding Molluscs belonging to a group which is characterized by the possession of a crawling foot among the inhabitants of the deep sea, where such an organ is useless. But the *Ianthinas* are fitted for this peculiarity of habit by the possession of their vascular float, while the foot of the *Atalanta* is divided into two lobes which it uses for purposes of progression after the manner of fins. Mr. Traill was enabled to make some minute observations on the organs of sight possessed

by these curious little animals. The second species of which a single individual only was obtained has the shell covered by a strong epidermis the lower edge of which is prolonged into a broad keel serving to sustain the shell in an erect position during the process of swimming. This species is probably new to Science.

Several specimens of a species of *Glaucus*, an aberrant group intermediate between GASTROPODS and PTEROPODS (although generally included among the former), were taken in Lat. 34 S. These are without shells but are furnished with lateral symmetrical appendages which are supposed to be bronchiæ and also serve for purposes of locomotion.

Dr. Traill's specimen differs from the common kind and appears to have been considerably mutilated. It may prove to be new.

But the richest harvest was obtained in the class of PTEROPODS. Of the 8 or 9 genera constituting the family of *Hyaleidæ* in this group, numerous specimens were obtained belonging to *Hyalea*, *Cleodora*, *Cuviera* and *Creseis* or *Theca* and one species of *Limacina*. The genus *Hyalea* was particularly prolific of species. Some it is probable have now been met with for the first time. Their specific characters are carefully pointed out and all are faithfully represented in the drawings.

Mr. Traill has some excellent remarks on the analogy between the organization of the young of some kinds of GASTROPOD MOLLUSCS and that of the adult PTEROPOD, and has observed that the young of the *Cypræa* or Cowry shell when first released from the egg or capsule and before they are able to crawl, exhibit a mode of progression very similar to that of the PTEROPODS.

The greater part of the specimens described were captured in the night, the habits of most of the genera being more or less crepuscular or nocturnal, except the genus *Creseis* which was often met with during the day.

Dr. Traill's memoir was referred to the Committee of Papers, and will appear in the Journal.

Thursday, 11*th December* 1856.

The Hon'ble WALTER ELLIOT, President in the Chair.

The Secretary laid before the Meeting the state of the Society's Funds, up to the termination of the present year, 1856.

LIABILITIES.	RS.	A.	P.	ASSETS.	RS.	A.	P.
Due to Messrs. Allen & Co. for Books, Periodicals, &c.	1439	3	4	Balance in hand of Treasurers	2003	5	11
Due to Deposits of 5 Third Class Subscribers........	50	0	0	Arrears of Subscriptions....	316	0	0
Excess of Assets over Liabilities	830	2	6				
	2319	5	10		2319	5	11

Resolved, that the Statement is satisfactory, and be published in the Journal for the information of Members of the Society.

Dr. Cleghorn read a paper on the Sand-binding Plants of the Coromandel Coast, in which he mentioned eight species of these useful plants, more or less serviceable in strengthening the beach between the Saluting Battery and St. Thome. Representations of these binders lithographed in Dumphy's best style were laid before the Meeting, showing the distinctive character of the respective plants. Dr. Cleghorn points out the soil and situation in which these plants are best calculated to succeed, and hopes to find leisure to contribute similar notices from time to time under the head of Notulæ Botanicæ. The thanks of the Meeting were voted to Dr. Cleghorn for his able and interesting communication.

The following Books and Papers were presented to the Society.

1. Geschichte Wassaf's—Persisch Herausgegeben und Deutsch übersetzt von Hammer-Purgstall, *from the Author.*

2. Correspondence respecting Rain Gauges, *from the Chief Secretary.*

3. A notice of the late Storm, of the 20th Nov. 1856, *from the H. Co.'s Astronomer.*

4. Diagrams of Barometrical and Thermometrical Curves for 1852, 1853, 1854 and 1855, *from the H. Co.'s Astronomer.*

5. Meteorological Register for October and November, *from the H. Co.'s Astronomer.*

Resolved, that the thanks of the Meeting be presented to the Donors, and that the Committee of Papers be requested to address a letter to Baron Hammer von Purgstall to convey to him the thanks of the Society for his donation to the Library.

[The following additional information regarding the storm of the 20th November was furnished by Dr. CLEGHORN, but too late for insertion under its proper head of Scientific Intelligence.]

Effects of the Gale of 20*th November* 1856 *at the Agri-Horticultural Society's Garden, Madras.*

I regret to state that the injury done to this garden during the late gale has been very considerable, and has surpassed that of any similar visitation, since I have been a Member of the Society.

As it seemed desirable that the more notable effects of the atmospheric disturbance on the vegetable kingdom should be recorded, I have prepared a list of the trees and shrubs which were particularly damaged. Being desirous of ascertaining which of our noble avenue trees suffered the most, I addressed a letter to Col. Boulderson requesting him to favor me with the number of trees blown down by the tempest, or mutilated in their trunk, or shattered in their branches.

The following summary of the Police Return of trees fallen, &c. on public ground within the limits of Madras, conveys as clearly as possible, the information obtained as to the nature and extent of the damage inflicted upon this untoward occasion.

No. of Trees.	No. of Trees blown down.	No. of Trees broken.	No. of Trees injured.
Portia tree (Thespesia populnea).........	47	278	325
Odyan tree (Odina wodier)............	18	10	28
Korkapully (Inga dulcis)...............	38	13	51
Banian tree (Ficus Indica).............	11	8	19
Margosa tree (Melia Azedarach)	5	6	11
Cocoanut tree (Cocos nucifera)..........	5	1	6
Valum tree (Acacia arabica)............	2	1	3
Asoca tree (Guatteria longifolia).........	1	0	1
Connay tree (Cassia fistula)............	2	0	2
Thane tree (Guazuma tomentosa)........	1	0	1
Total..	130	317	447

It will be observed that a large proportion of the trees blown down or broken (325) is of one species.

Portia (Thespesia populnea).—Suffered most of all the avenue trees, and it was particularly noted that trees grown from cuttings were more extensively damaged than seedlings.

Banian (Ficus Indica).—When allowed to strengthen its position by its natural supports, this tree does not suffer, but when the props are cut away, as is customary by the roadside, it is very liable to be uprooted. Two were blown down on the Mount Road and falling against the new iron railing of the Cathedral, caused considerable damage.

Adansonia digitata—The Baobab, with its enormous trunk and stout branches suffered little injury generally. One handsome tree in the gardens gave way at the root, and remained in a slanting position like the leaning tower of Pisa. The trunk subsequently broke transversely about the middle.

The Palms with their unbranched stems, and Casuarinas with their acicular foliage yielded to the gale and suffered the least. The crown of *Caryota urens* was damaged.

The Plantain from the broad expanse of its delicate foliage always suffers on these occasions, the cellular stem snaps across, and the leaves being torn as it were into narrow ribbons, dangle from the midrib and then fall off.

The Betel vine plantations in many places were greatly damaged and trellices laden with the Snake Gourd (Trichosanthes anguina,) and other Cucurbitaceous fruits were levelled, causing much loss to the Market Gardeners.

Trees with soft or brittle wood as *Agati grandiflora, Bignonia suberosa, Moringa pterygosperma, Visenia umbellata, Carica Papaya &c.*, were either entirely prostrate, or had their branches strewed about in almost every compound.

I am not aware that any one except Dr. Wallich in the Journal of the Agri-Hort. Society of India (vol. I, p. 3) and Dr. Buist (Trans. of the Bombay Geogl. Soc. vol. XII, p. 58) has recorded his observations or paid much attention to this subject, and it seems to me a matter of no small importance in connection with planting of trees along the public roads.

I am happy to say that none of the plants in the Society's gardens irreparably damaged was unique.

A very fine flowering specimen of *Spathodea companulata*, was quickly set up by Mr. Jaffrey, and fortunately saved.

A Pandal covered with a number of our choicest creepers *Thunbergias*, *Passifloras* and *Poivreas* was thrown down, and these interesting climbing plants were much damaged, but they have generally recovered.

The Conservatory fortunately stood well, and the plants in pots being sheltered in shady corners were comparatively uninjured.

Several graft mango-trees were blown down, and the Graft layers attached were destroyed.

It was very interesting to observe how quickly the wounded trunks and mutilated branches healed up spontaneously. If the trees are attended to early, and the gaps and fissures spliced up with cotton rope the cure is remarkably rapid.

Abstract of the Meteorological Observations kept at the Madras Magnetic Observatory.

DAILY MEANS.

July 1856.

Date.	Barometer reduced to 32° (Inches)	Thermometers. Means. Dry °	Wet °	Max. °	Mini. °	Wind.	Rain. (Inches)	Remarks.
1	29·619	85·5	77·2	96·2	81·5	S by E	0·413	Overcast
2	·634	84·0	77·9	92·8	81·2	S W	·013	do
3	·645	84·1	77·3	94·6	79·7	S W	......	do
4	·670	84·0	78·2	95·1	78·8	S	·295	do
5				95·7	81·1	S	......	
6	·706	84·0	78·4	93·4	80·4	?	......	Cloudy
7	·730	84·0	77·2	97·8	79·6	S S W	......	do
8	·714	86·3	78·9	99·7	81·9	S W	·460	do
9	·705	83·6	77·2	95·7	79·3	?	......	Overcast
10	·674	84·4	78·0	95·0	80·1	S W	......	do
11	·627	85·4	77·6	96·6	80·2	S W	......	do
12				99·0	79·1	W	·008	
13	·644	85·4	77·5	99·3	80·8	S W	·004	do
14	·665	88·2	77·0	96·8	83·3	S W	......	do
15	·661	88·5	78·6	100·5	83·6	W S W	......	Cloudy
16	·670	87·7	78·7	100·9	82·3	S W	......	do
17	·703	88·6	78·4	100·5	83·2	?	......	do
18	·706	87·8	78·2	101·4	82·0	?	......	do
19				99·0	84·3	S W	......	
20	·694	86·8	76·8	95·3	84·1	S W	......	Overcast
21	·678	87·4	75·0	98·2	82·6	S W	......	do
22	·668	88·9	74·4	99·8	82·4	S W	......	Cloudy
23	·689	88·9	74·6	99·6	82·5	W by S	......	do
24	·737	87·7	75·0	95·7	83·1	W by S	......	Overcast
25	·761	87·1	76·4	98·9	83·0	W by S	......	Cloudy
26				96·8	81·1	W S W	·498	
27	·728	87·2	76·5	100·2	80·7	S W by S	......	do
28	·766	83·0	77·2	95·4	79·1	?	·597	Overcast
29	·744	81·0	76·6	89·6	78·9	S W by W	·092	do
30	·710	81·2	76·2	93·3	76·9	S W	·460	do
31	·708	81·8	76·4	93·4	78·1	S W	·476	do
Means	·691	85·6	77·1	97·0	81·1		3·316 Sum	

August 1856.

Date.	Barometer reduced to 32° (Inches)	Thermometers. Means. Dry °	Wet °	Max. °	Mini. °	Wind.	Rain. (Inches)	Remarks.
1	29·720	83·2	76·6	95·3	78·6	S W	0·080	Overcast
2				95·0	78·8	W	......	
3	·750	84·5	76·0	94·6	79·3	W by S	......	Cloudy
4	·800	85·4	76·6	96·3	80·5	W	·045	Overcast
5	·834	83·8	77·8	93·8	80·5	?	·010	do
6	·840	83·2	77·5	94·4	79·0	?	......	Hazy
7	·788	85·4	78·1	96·4	80·4	?	......	do
8	·774	86·0	78·5	96·6	81·4	S	......	do
9				95·8	80·2	S W	......	
10	·758	85·5	78·3	97·2	81·2	S	......	do
11	·723	85·4	78·3	97·1	79·3	S W	·368	do
12	·728	85·4	79·8	97·2	80·7	S W	......	Cloudy
13	·728	84·7	78·4	94·9	81·0	S W	......	Overcast
14	·750	82·7	76·7	93·5	78·5	S W	......	do
15	·732	84·8	77·2	96·0	79·3	W S W	......	Cloudy
16				93·2	81·2	S S W	·062	
17	·718	81·4	77·2	84·9	78·8	S W	·403	Overcast
18	·716	79·9	76·2	87·4	75·3	W	·634	do
19	·758	80·1	76·1	89·5	77·0	W	·220	do
20	·750	81·1	77·1	92·1	77·0	W by S	·385	do
21	·744	83·5	78·5	93·9	79·4	W by S	......	do
22	·739	83·0	78·7	91·4	77·8	?	1·115	Hazy
23				92·3	78·1	?	0·058	
24	·752	82·1	77·9	93·8	79·0	W	·042	Cloudy
25	·741	82·6	77·5	93·0	76·8	W	2·180	Overcast
26	·751	79·6	77·0	87·4	78·0	?	......	do
27	·742	81·7	78·2	92·1	78·6	S	0·055	Cloudy
28	·743	80·8	77·7	88·1	78·1	S S W	·008	Overcast
29	·753	80·6	76·6	87·4	77·9	S W	......	do
30				88·7	77·6	S W by W	......	
31	·787	80·7	74·0	88·0	78·9	S W by W	......	do
Means	·755	83·0	77·4	92·8	79·0		5·665 Sum	

September 1856.

Date.	Barometer reduced to 32° (Inches)	Thermometers. Means. Dry °	Wet °	Max. °	Mini. °	Wind.	Rain. (Inches)	Remarks.
1	29·777	82·6	73·8	94·1	78·2	S W	......	Cloudy
2	·762	81·3	73·9	94·2	78·7	W S W	......	do
3	·785	85·4	74·1	95·0	80·3	W	......	Hazy
4	·825	85·9	76·9	94·9	81·4	?	......	do
5	·840	85·5	78·1	94·9	81·8	?	......	Cloudy
6				94·7	80·3	?	......	
7	·812	85·3	78·6	95·5	79·9	?	......	do
8	·834	85·1	78·1	95·5	79·8	?	......	do
9	·816	85·4	76·4	96·4	80·1	S W	......	do
10	·780	85·0	76·0	95·7	81·2	W by S	......	do
11	·779	85·6	73·6	91·1	82·2	W	......	Overcast
12	·743	85·8	73·0	91·7	82·0	W by N	......	do
13				92·6	76·3	W	0·608	
14	·758	84·2	77·0	93·7	79·4	S by W	......	do
15	·761	82·9	77·9	93·5	78·6	S W	......	do
16	·770	81·6	76·9	95·2	80·2	S W	......	Cloudy
17	·796	81·7	76·6	96·2	80·2	S W	......	do
18	·822	85·3	77·5	95·3	80·5	S W	......	do
19	·817	85·5	77·0	95·2	81·1	W	......	do
20				93·7	80·2	?	......	
21	·833	84·8	78·2	93·8	80·3	?	......	Hazy
22	·833	84·6	78·3	96·3	80·7	S W	......	do
23	·806	83·3	78·1	91·8	80·1	S W	·135	Cloudy
24	·787	82·5	77·2	92·0	78·7	W N W	·063	Overcast
25	·772	82·9	78·1	92·8	78·8	E by S	......	Cloudy
26	·779	82·8	77·5	91·9	78·1	S W	·003	Overcast
27				91·4	80·5	?	·137	
28	·783	81·2	77·1	90·2	77·0	W	......	do
29	·800	82·6	78·5	90·7	78·8	S	......	Hazy
30	·838	83·8	78·4	92·9	78·8	W by N	·013	do
Means	·798	84·3	76·8	94·1	79·8		0·859 Sum	

? This mark signifies that no means can be taken owing to the variable state of the wind.

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

HOURLY MEANS.

Gottingen Mean Time		Noon.	1*	2	3	4	5	6	7	8	9*	10	11*	12	13	14	15	16	17	18	19	20	21	22	23	Means
Madras Mean Time		h m 4 41 P. M.	h m 5 41	h m 6 41	h m 7 41	h m 8 41	h m 9 41	h m 10 41	h m 11 41	h m 12 41	h m 13 41	h m 14 41	h m 15 41	h m 16 14	h m 17 41	h m 18 41	h m 19 41	h m 20 41	h m 21 41	h m 22 41	h m 23 41	h m 0 41	h m 1 41	h m 2 41	h m 3 41	
Barometer 32°=29 ×	July 1856.	Inches ·617	In. ·630	In. ·651	In. ·679	In. ·702	In. ·716	In. ·723	In. ·714	In. ·702	In. ·693	In. ·685	In. ·636	In ·687	In. ·699	In. ·718	In. ·735	In. ·744	In. ·746	In. ·731	In. ·710	In. ·686	In. ·663	In. ·641	In. ·626	Inches ·691
	August do	·683	·699	·722	·749	·773	·788	·790	·781	·765	·754	·743	·742	·740	·752	·770	·792	·805	·809	·796	·779	·763	·729	·707	·690	·755
	Septr. do	·730	·746	·767	·790	·813	·830	·826	·816	·803	·794	·784	·789	·793	·809	·829	·850	·862	·861	·815	·817	·786	·757	·736	·724	·798
Dry Thermometer...	July 1856.	° 90·3	° 88·3	° 86·0	° 84·7	° 83·8	° 83·1	° 82·7	° 82·1	° 81·5	° 81·4	° 81·1	° 80·8	° 80·4	° 80·1	° 81·1	° 83·4	° 85·8	° 87·9	° 89·7	° 91·4	° 92·6	° 93·1	° 92·5	° 91·7	° 85·6
	August do	87·1	85·4	83·5	82·3	81·8	81·2	80·6	80·3	79·9	79·5	79·0	78·7	78·4	78·1	79·0	80·8	82·8	84·8	86·4	87·7	88·5	88·5	88·6	88·0	83·0
	Septr. do	88·3	86·4	54·5	83·8	83·3	82·8	82·1	81·5	81·2	80·7	80·3	79·9	79·5	79·0	79·5	81·8	84·1	86·5	88·2	89·6	90·4	90·4	90·3	89·7	84·3
Wet Thermometer...	July 1856	78·6	78·2	77·7	78·0	77·7	77·3	77·0	76·6	76·2	76·1	75·9	75·6	75·3	74·9	75·5	76·3	76·7	77·0	77·4	77·8	78·1	78·4	78·8	79·0	77·1
	August do	79·3	78·9	78·7	78·0	77·8	77·6	77·3	77·2	76·7	76·0	75·8	[illegible]	75·4	75·3	75·8	76·4	77·0	77·6	77·9	78·0	78·5	78·7	79·0	79·2	77·4
	Septr. do	77·8	77·7	77·6	77·5	77·5	77·1	76·9	76·8	76·6	76·4	76·1	75·8	75·5	76·1	75·3	75·9	76·3	76·6	76·8	77·2	77·3	77·6	77·8	77·9	76·8

* The Numbers in these Columns are not Observed but interpolated for the sake of obtaining the daily means.

MADRAS,
1st *October*, 1856.

W. S. JACOB,
Director of the Madras Observatory.

Plan and Section of the Loonar Lake.

Spinifex Squarrosus, Linn.

On transfer paper by C. Balakistna and Lith^d by J. Dumphy, Govt Lith^c Press Central Office of Public Works, Fort St George

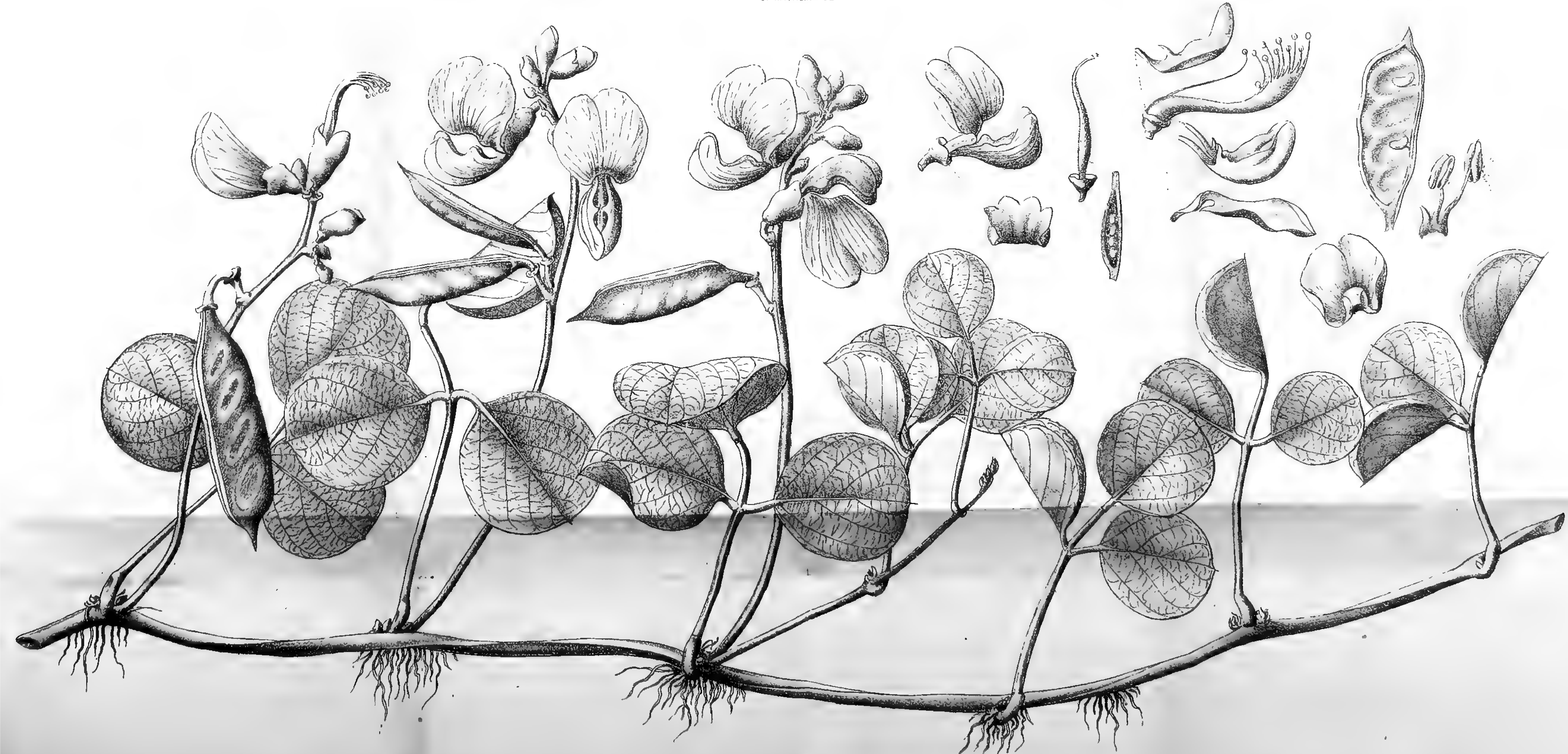
IPOMÆA PES CAPREE.

GOATS FOUT CREEPER, OR RABITWEED.

ON STONE BY [illegible] AND LITH BY [illegible] AT THE GOV[illegible] LITH PRESS CENTRAL OFFICE [illegible] FORT ST GEORGE

ON TRANSFER BY [illegible]

CANAVALIA OBTUSIFOLIA. D.C.



ON STONE [illegible] AND LITH. BY [illegible] GOVT. LITHC. PRESS, CENTRAL OFFICE [illegible] FORT ST. GEORGE.

MICRORHYNCHUS SARMENTOSUS D.C

THE TODA VOCABULARY BY THE REV. F. METZ.

(Continued from last Number of the Journal.)

B.

Baby	పోపెన్. *pópen.*
Back	ఉఫ్, *uf.*
Backbiting	పెర్కిటి. *perkiti.*
Backward	బేక్. *bék.*
Badge	పారు. *páru.*
Bag	తీరం. *tíram.*
Bail (I am)	పొన్నాయిస్ బిని. *ponnáyisbini.*
Balance, scales.	తరసు. *tarasu.*
Ball of a gun	తెర్ష్గుడ్డు. *tershguḍḍu.*
Bald	తార్మడ్డ్. *tármadd.* (*litt. open head.*)
Bamboo	కైలు. *kailu.*
Bat	బర్కోన్. *barkon.*
Bathe	నీరార్థ్బిని. *nírárthbini, and* నీరర్ష్బిని. *nírarshbini.*
Battle	దడ్డు. *daḍḍu.*
Bark of a tree	మేన్పుట్. *ménpuṭ.*
Bark (verb)	క్వర్థ్బిని. *kwarthbini.*
Barley	గాజ్జి. *gájji.*
Barren	బరడి. *baraḍi.*
Basket	మకరి, గూడు. *makari, gúḍu.*
Beat	బుర్థ్వెర్ష్బిని. *burthvershbini.*
Be	ఎర్ష్బిని *ershbini.*

Bean	ఎవర్. *evar.*
Bear (noun)	కార్. *kár.*
Bear (verb)	హొత్త్స్బిని. *hottsbini.*
Beard	మొయి. *moyi.*
Beast	ముర్కిటి. *murkiti.*
Bee	జేఙ్గూర్. *jéngúr.*
Bee's wax	కర్ర్. *karr.*
Bedstead	కెట్ట్హ్స్. *keṭṭ'hs.*
Before	ముద్ద్. *mudd.*
Beg	బేడ్వర్ష్బిని. *béḍvershbini.*
Beggar	బేడిగార్. *béḍigár.*
Behead	మొర్ర్అత్త్స్బిని. *morr-attsbini.*
Behind	హిండాడు *hinḍádu,* & పిండల్క్. *pindalk.*
Believe	నబ్బ్వర్ష్బిని. *nabbvershbini.*
Below	ఎర్క్. *erk,* నెష్క్. *neshk.*
Belly	బీర్. *bír.*
Between	నర్థ్కాశి. *narthkáṣi.*
Be it so	అత్తనమ. *attanama (means also) enough.*
Bell	గొంగ్. *gong.*
Bend	బత్స్వర్ష్బిని. *batsvershbini.*
Beyond	ఆతడు. *átaḍu.*
Beware of	అతైఖిర్. *ateikhir, litt. be at that side.*
Big	ఎతుద్. *etud.*
Bile	పిత్త. *pitta.*
Bind	కట్ట్హ్స్బిని. *kaṭṭ'hsbini.* కట్టిహికెన్. *kaṭṭ'ḥikhen.*

Bird — బిళ్ట్. *biḷt.*

Bird cage — బిళ్ట్గూడ్. *biḷtgúḍ.*

Bite (and bark) — క్వర్థ్బిని. *kwarthbini.*

Bison — అమోఫ్. *amof.*

Bitter — కథ్స్తుడి. *katstudi.*

Black — కర్థ్తి. *karthti.*

Blackberry ఏళ్పోం. *éḷpóm.* మిళ్పోం, *milpóm.*

Blind కణ్ణు కాణడి. *kaṇṇu káṇadi.*

Bliss — సుగ్గం. *suggam.*

Blood — బాఖ్. *bákh.*

Board, plank — ఴా. *tzhá.**

Bog, swamp — కెన్నేర్. *kennér.*

Boat — అరిగిలు. *arigilu.*

Born (I was) — బెర్థ్బిని. *bert'hbini.*

Boil — పుణ్ణు. *puṇṇu.*

Boils (it) బుకితి. *bukiti.* & బుళ్క్థ్తి. *bulkthti.*

Bold — ఎళ్థి. *elthi.*

Bone — ఎళ్ఫ్. *elph.*

Bottle — పుట్ఠి. *puṭṭ'hi.*

Boundary — తెవ్వర్. *tevvar.*

Bow (a) — బిర్ష్. *birsh.*

Bowels — గుర్ర్. *gurr.* గ్వుర్ర్. *gvurr.*

Box — పెట్ఠి. *peṭṭ'hi.*

Boy మోఖ్, *mokh,* మోఖ్వర్ష్, *mokhvarsh.*

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* The (ఴ) is the peculiar Toda sound something like the tamil ழ, which is usually rendered by *zh.*

Breast నెజ్జిగుడ్డి, *nejji guḍḍi*, woman's breasts. మొఱ్, *mozh*, మొర్ష్. *morsh.*

Bracelet తూవల్పడి. *túvalpadi.* & తూల్వడి. *túlvadi.*

Bramble ఆన్మలి. *ánmali.*

Branch of a tree తువర్. *tuvar.*

Brass పితలి. *pitali.*

Break మిర్ధ్స్ వెర్ష్బిని, *mirdhs vershbini*, వొడడ్వెర్ష్బిని, *voḍadvershbini.*

Breath, life తీ. *tí.*

Breathlessness ఉప్పజ్. *uppaj.*

Breed కాటిఖెన్. *káṭikhen.*

Bribe కెక్కొలి. *kekkoli.*

Bring తష్కెన్, *tashken*, తడ్డ్స్బిని. *taddsbini.*

Brook పా. *pá.*

Brother (elder) అణ్ణ, *aṇṇa*, ఎన్నన్, *ennan;* younger brother నొర్వెత్, *norvet.*

Brother in law బొయిఆళ్. *boyi áḷ.*

Brow (eye) కణ్ణుగోర్మీర్ *kaṇṇugórmír.*

Buffaloe ఏర్. *ér.*

Build కట్ట్స్బిని. *kaṭṭ'hsbini.*

Burden పర్ర్. *parr.*

Burn తుట్ట్ వెర్ష్బిని. *tuṭṭ'h vershbini.*

Business కెలస్ *kelas.*

Butter బెణ్ణ్. *beṇṇ.*

Butter milk మచ్. *mach.*

Butterfly కప్పాన్. *kappán.*

C.

Cage, trap గూడ్. *gúḍ.*

Calf కర్ర. *karra.*

Call బిర్ష్ ఎర్షిబిని. *birsh ershbini.*

Calumniator జాడికారన్. *jáḍikáran.*

Camel వొట్ఠి. *voṭṭ'hi.*

Carriage wheel, potter's wheel, బండి. *banḍi.*

Cast away తలిబుట్ట్స్బిని. *talibuṭṭ'hs bini.*

Castle, Bungalow of Europeans క్వాట్. *kwáṭ.*

Cat కొట్టి. *kotti.*

Catch పార్వత్త్స్బిని. *parvatthsbini.*

Centre నడుఫ్. *naḍuf.*

Chaff క్వస్ట్. *kwast.*

Chain తకోల్. *takól,* తగర్ష్. *tagarsh.*

Chalk, Chunam నూర్. *núr.*

Chat ఆర్వొత్బిని. *árvotbini.*

Cheap. ఎతియాది. *etiyadi.*

Cheat మోసమాడ్వెర్ష్బిని, *mósamáḍwershbini.*

Cheek ఆనొగ్. *ánog.*

Child పోపన్. *pópan.*

Chin మీడ్. *míd.*

Claw కులూర్. *kulúr.*

Clay మున్ను. *munṇu.*

Clean నార్థ్ *nárth,* is it clean నార్థెర్ష్కా, *nárther-shká.*

Cloud — మజ్జు. *majju.*

Climb — యెత్త్స్బిని. *yettsbini.*

Club — కుండ. *kunḍa.*

Coal — కరి. *kari.*

Cob — ట్వాలజంగూడ్. *twálajangúḍu.*

Cocoanut — తెంగొకాయి. *tengokáyi.*

Cold, feverish cold — పెర్థ్తి. *perthti.*

Cold, from cold weather — క్వొర్థ్తి. *kworthti.*

Colour — సాయ. *sáya.*

Come — వష్కెన్. *vashken.* ఫష్కెన్. *fashken,* బడ్థ్బిని, *badthbini.*

Command — అప్పణె. *appaṇe.*

Conjurer — పిలికారన్. *pilikáran.*

Companion, friend — యేకాళ్. *yékáḷ.*

Comprehend — అర్థ్బిని. *arthbini.*

Consent — వొబ్బెర్ష్బిని. *vobbershbini.*

Corn, grain, — బత్తం. *battam.*

Corner — మూలె. *múle.*

Corpulent — బల్బిర్. *balbir.*

Cotton — పత్తి. *patti.*

Cough — పుటిటి. *putiti.*

Count — యెనిస్బిని. *yenisbini.*

Countenance — కొన్ మున్న. *konmunna.*

Country — నోర్. *nór,* శీమె, *ṣíme.*

Courage — ఎలథి. *elathi.*

Cowries — నెర్పాలి. *nerpáli.*

Cover, hide — ముచ్వెర్ష్బిని. *muchvershbini.*

Cow — దనం. *danam.*

Crab — తెగుళి. *teguḷi.*

Cream — ఫత్థ. *p'hatha,* బెణ్ణు. *beṇṇu.*

Cripple — కుట్ఠన్. *kuṭṭ'han.*

Crooked — తొర్క్. *tork.*

Crow — కాక్. *kák.*

Cry అడ్థ్బిని. *aḍthbini,* కణ్ణనీర్ హాక్స్బిని. *kaṇṇa nír haksbini.*

Cultivate కాళ్గెర్ష్బిని, *kazhgershbini,* ఉళ్స్బిని, *uzhsbini.*

Curse — బర్తివెర్ష్బిని. *bartivershbini.*

Custom house — సుక్కకట్ఠ్. *sukkakaṭṭ'h.*

Cut అర్తివెర్ష్బిని. *artivershbini,* ఏస్వెర్ష్బిని, *ésvershbini.*

D.

Dance — ఆడ్స్బిని. *áḍsbini.*

Dark — యిళ్. *yizh.*

Daughter — కుఖ్. *kukh.*

Daughter in law — మాత్వెథ్. *matveth.*

Day — నాళ్. *náḷ.*

To day — ఎద్దు. *eddu.*

Day after tomorrow — పేర్నేర్. *pérnér.*

Deaf — కివిడు. *kiviḍu.*

Death — కేడు. *kéḍu.*

Debt — కడన్. *kaḍan.*

Deceive — మోసమాడ్స్బిని. *mosamáḍsbini.*

Deceiver — వొలాడి. *voládi.*

Deep — కీను. *kínu.*

Demon బూత్. *bút.*

Deny ఆడ దియెడ్డ్ ఎష్ట్సిబిని. *ádadiyeddeshtsbini.*

Depart పోకెని. *pókeni,* పోయిస్బిని. *poyisbini.*

Deride కర్థ్బిని *karthbini.*

Desert, forsake బుట్ట్ హ్వెర్ష్బిని. *buṭṭ'hvershbini.*

Descend య్యీళ్ఖ్బిని. *yízhkhbini.*

Desire ఆవెలు. *ávelu.*

Diarrhœa (I have) బిర్వ స్బిస్చి, *bírvasbischi.*

Difference హెచ్క డిమె. *hechkadime.*

Dig అడెర్ష్బిని. *aḍershbini.*

Diminish (neutre) ఎత్తిగ డెర్ష్బిని. *ettigadershbini.*

Die కేడిఖెని. *kéḍikheni,* కేడ వెర్ష్బిని. *kéḍavershbini.*

Dirt అర్ష్ బిడర్. *arsh bidar.*

Dirty (I make) కర్ష్కెవెర్ష్బిని. *karshkevershbini.*

Dishonour నానిపేమ్. *nánipém.*

Disappear కాణవెర్ష్బిని. *káṇavershbini.*

Dismiss తళివెర్ష్బిని. *taḷivershbini.*

Dispute, debate కుడ్వెర్ష్బిని. *kudvershbini.*

Ditch కుడి. *kuḍi.*

Divide పాల్మాడ్స్బిని. *pálmáḍsbini.*

Dog నోయి. *nóyi.*

Door పషాళ్. *pasházh.*

Drive వోడివెర్ష్బిని. *vóḍivershbini.*

Drink ఊడ్స్బిని. *úḍsbini.*

Drown మ్ళూగివెర్ష్బిని. *mzhúgivershbini.*

Drum బర్ర. *barra.*

Drop కాట్చి. *káṭchi.*

Drum, verb బర్రగెర్ష్బిని. *barragershbini.*

Dry వొనుగెర్ష్బిని. *vonugershbini.*

Dull పేరాడ్. *péráḍ.*

Dumb మూగన్. *múgan.*

Dung గొపారం. *gopáram,* కార్ష్. *kársh.*

Dwarf కురుడమొఖ్. *kuruḍamokh.*

E.

Eagle పథు. *pathu.*

Ear కెవ్. *kev.*

Earth, soil బూమి. *búmi.*

Echo (it is) నేపెర్థ్చి *néperthchi.*

Eat తీన్స్బిని. *tinsbini,* తెద్స్బిని. *tedsbini.*

Eclipse గ్రెండచి. *grendachi.*

Egg మొట్ఠె. *moṭṭ'he.*

Elegant నార్థి. *nárthi.*

Eight ఎట్ఠ్. *eṭṭ'h.*

Eighteen బోట్. *bóṭ.*

Eighty ఎంబొథ్. *emboth.*

Enemy అఖ్గారన్. *akhgáran.*

Enough అత్తనమ. *attanama,* గనం. *ganam.*

Elbow గొర్మగై. *gormagai.*

Elephant ఆన్. *án.*

Elk మోఫ్. *móf.*

Embrace ఉల్కటెర్ష్బిని. *ulkaṭershbini.*

Empire	శీమె. *ṣíme,* నోర్. *nór.*
Equal	సరి. *sari.*
Ever	ఎత్వనెత్వన్. *etvanetvan.*
Excrement	కార్ష. *kársha.*
Expel	తళివిట్స్బిని. *taḷivitsbini.*
Expenditure	సల్లం. *sallam.*
Eye	కణ్ణు. *kaṇṇu.*
Enchanter	పిలికారన్. *pilicáran.*
End (verb)	తీరిస్బిని. *tírisbini.*
Enter	ఒళ్పోకెని. *oḷpókeni.*
Envy	హొట్టెకిచ్చ్. *hoṭṭ'he kichch.*
Error	క్వర్ర్. *kvarr,* తప్ప్ *tapp.*
Evening	ఏకార్. *ékár.*
Every	ఎల్లా. *ellá.*
Excise	సుక్కం. *sukkam.*

F.

Fall	బుడుడువెర్ష్బిని. *buḍuduvershbini.*
Face	కొన్మున్న. *konmunna.*
Falsehood	పెర్కితి. *perkiti.*
Family	పాల్తియాళ్. *páltiáḷ.*
Faith	నంబిక్. *nambik.*
Fat	బెఖితి. *bekhiti.*
Fane, temple	గుడి. *guḍi,* దేర్మనె. *dérmane.*
Far	బధ్ఖ్. *badhkh.*
Farmer	వొకలిఖెన్. *vokalikhen.*

Father — ఐయన్. *aiyan.*

Fatherless — తొబ్బారి. *tobbári.*

Fault — క్వర్ర. *kwarra.*

Fault (to commit) క్వర్రగిసివర్ష్బిని. *kwarragisivershbini.*

Fault it is a క్వర్రబుడిదివేష్చి. *kwarrabuḍidiveschi.*

Fear అజ్బిని. *ajbini.* I fear not అజ్జెని. *ajjeni.*

Feast — హబ్బం. *habbam.*

Feather — తూఫి. *túfi.*

Fever (I have) — బిష్కెవర్ష్బిని. *bishkevershbini.*

Five — యిచ్. *yich.*

Field — కాఴ్. *kázh.*

Fill — బుర్డ్స్బిని. *burdsbini.*

Finger — కైవెఴ్. *kaivezh.*

Fire — డిట్త్. *ḍitth.*

Fireplace — వర్ర్ష్. *varrsh.*

Firewood — బెర్ఖ్. *berkh.*

Firestone, flint. — టిట్ముక్. *titmuk.*

Fish — మీన్. *mín.*

Fist — కెపొట్. *kepot.*

Fife — క్వేఴ్ష్. *kwézhsh.*

Flea — డెల్త. *deḷta.*

Flee — వోడ్స్బిని. *vódsbini.*

Flesh — బువడ్. *buvaḍ.*

Floor — నెల్లు. *nellu.*

Flour హిట్ట్. *hitt'h.*

Flower పూఫ్. *púf.*

Fly (a noun) ఏపి. *épi.*

Fly (verb) పార్థ్బిని. *párthbini.*

Foam బుక్కు. *bukku.*

Fog మజ్జు. *majju.*

Fool పుట్ట్. *puṭṭh.*

Fore head నెట్టి. *netti.*

Forest ద్వార్ష్. *dwársh,* మేన్. *mén.*

Four నాంక్. *nánk.*

Fourteen పాంక్. *pánk.*

Forty నాజ్బొథ్. *názhboth.*

Forward ముడ్క్. *mudk.*

Foot కాళ్. *káḷ.*

Foreigner పరదాశ్. *paradáṣ.*

Forget మరెద్వెర్ష్బిని. *maredwershbini,* తూబఖరి వెర్ష్బిని. *túbakharivershbini.*

Forgive ఉల్ట్ మాడ్స్బిని. *uḷtmáḍsbini.*

Fowl క్జూడి. *kzhúḍi.*

Fox నరి. *nari.*

Friend ఏకాళ్. *ékáḷ.*

Frog కప్పున్. *kappun.*

Frost పని. *pani.*

Fruit పోం. *póm.*

Fruit tree పోమ్మేన్. *pómmén.*

Funeral — కేడు. *kéḍu.*
Fur — తూవఴ్. *túvazh.*
Fart — బుర్క్. *burk.*

G.

Gain — ఉళివల్. *uḷival.*
Gall — పిత్త. *pitta.*
Gallows — తూక్మేన్. *túkmén.*
Garden — తూవట్. *túvaṭ.*
Garlics — బెళూల్డి. *beḷúḷdi.*
Gather — కూట్స్బిని. *kúṭsbini.*
Gate — పషాఴ్. *pasházh.*
Gem — కల్ముత్తురు. *kalmutturu.*
Ghee — నేయి. *néyi.*
Ghost — బూత్. *bút.*
Giant — అర్కోతష్. *arkotash.*
Girl — కూఖ్. *kúkh.*
Give — కొట్ట్స్బిని. *koṭṭ'hsbini* తష్కేన్. *táshken.*
Go — పోఖేని. *pókheni.*
Glow worm — మిన్పూఫ్. *minpúf.*
Goat — ఆడు. *áḍu.*
God — దేర్. *dér.*
Gold — దిస్న. *disna.*
Goldsmith — తట్ఠన్. *taṭṭ'han.*
Good — వొళ్తి. *voḷti.*
Gooseberry — తౌట్వోమ్. *tóuṭvóm.*

Grain	బత్తం, *battam.*
Grandfather	పీయెన్. *píyen.*
Grandmother	పీయవ్వ్. *píyavv.*
Grandson	మర్మొఖ్. *marmokh.*
Grass	పుల్లు. *pullu.*
Grasshopper	మట్ఠె. *maṭṭ'he.*
Gray	నరె. *nare.*
Great	ఎతుడ్. *etuḍ.*
Green	పచి. *pachi.*
Grief	దుక్కం. *dukkam.*
Grind	వొర్రిగల్లెర్ష్బిని. *vorrigallershbini.*
Grindingstone	వొర్రిగల్ల్. *vorrigall.*
Groan	బారాట్స్బిని. *báráṭsbini.*
Ground	నెల్లు. *nellu.*

H.

Hailstone (hailrain)	కఝ్ఝమా. *kazhzhmá.*
Hair	మీర్. *mír.*
Half	అడం. *aḍam.*
Hand	కోయి. *kóyi.*
Hard	గగాల్. *gagál.*
Hare	మీర్ష్. (*mürsh.*) *mírsh.*
Harlot	స్ఝూయి. *szhúyi.*
Hate	అఖ్వెర్ష్బిని. *akhvershbini.*

Hatred అఖ్. *akh.*

Halt కాలెట్ట్స్బ్ని. *kaleṭṭ'hsbini.*

Hammer కుటుపాడి. *kuṭupáḍi.*

Handle a తీర్ష్. *tírsh.*

Hang (suicide) మొరకట్ట్స్బ్ని. *morakaṭṭ'hsbini.*

Hang (another) తూక్వెర్ష్బిని. *túkvershbini.*

Harken వొరాట్స్బ్ని. *vóráṭsbini.*

Hatchet కుర్వాల్. *kurvál.*

Haughty గ్వొవెర్ష్బిని. *gwóvershbini.*

Hawk nose పథ్మితుఫ్. *pathmituf.*

Head మడ్డ్. *madd.*

Hear క్ఝేట్స్బిని. *kzhéṭsbini.*

Heart గెండి. *genḍi.*

Heat బిఝ్. *bízh.*

He అదుం. *adum.*

Heap గూధల్. *gúdhal.*

Heaven ఆమునొర్. *ámunór,* మెల్లొఖ్. *méllókh.*

Herd గుప్పి. *guppi.*

Heavy తూకడె. *túkade.*

Here యిల్ల్. *yill.*

Hew ఏర్స్బిని. *érsbini.*

Herb తూర్. *túr.*

Hiccup ఎష్కూర్. *eshkúr.*

Hide (reflexive) వొళ్ చ్వెర్ష్బిని. *voḷachwershbini.*

Hide (active) కర్థ్బిని. *karthbini.*

Hill డిట్ఠు. *diṭṭ'hu.*

Hire సంబొలు. *sambolu.*

Hog పడ్డి. *paddi.*

Hoof బాపు. *bápu.*

Hook దుర్క్. *durk.*

Hold పత్థ్స్బిని. *paththsbini.*

Honey తేన్. *tén.*

Honour మానం. *mánam.*

Horn కువర్ర్. *kuvarr.*

Horse కదరె. *kadare.*

Horse gram కాటి. *káti.*

Hot కాస్తి. *kásti,* it is hot కాసవిచి. *kásavichi.*

House ఆఴ్స్. *ázhs.* Badaga house or milk house పాల్తి. *pálti.*

How ఎత్తెత్. *ettett.*

Howl అర్స్బిని. *arsbini.*

Hungry బిరెథ్తి. *biréthti.*

Hundred వొన్నూర్. *vonnúr.*

Hunt బేటాట్స్బిని. *bétáṭsbini.*

Husband ఆళ్. *áḷ.*

Humbug పిటలాట్. *pitaláṭ.*

(To be continued.)

II. *Brief notices of Pelagian Mollusca collected on a voyage from England to Madras, during the months of April, May and June* 1856. *By* WILLIAM TRAILL, M. D.

IN throwing together the following observations it was my first intention to describe the various Mollusca met with, in the order of their classification, beginning with those highest in the scale, but on further reflection I did not think it would answer any useful purpose to do so. They are too few in number to represent the gradation of the different classes, which may be more clearly understood by a glance at any systematic work on the subject. By adhering rigidly to classification I should have very frequently, to reverse the succession of events. Moreover, authors are by no means agreed as to the exact position in the animal economy, which each group should hold: PTEROPODS for example according to the varying opinions of different authors, having successively occupied no less than three of the six Classes into which MOLLUSCA are usually divided. Upon the whole therefore, I thought it better to note down zoological facts and deductions in the order of their occurrence as being a method easier to myself and probably more intelligible to my readers.

In remarking on these animals, I have not been so much actuated by the belief that some of the species are new to science, as by the fact that Pelagic Molluscs in general, and PTEROPODS in particular, are comparatively little known. Although the indefatigable labours of such men as M. M. Rang, Quoy and Gaimard have greatly added to the number of ascertained species, yet in our knowledge of their specific distinctions and affinities much remains to be accomplished.

PTEROPODS are rarely seen either in public museums or private collections; their mysterious haunts in the unknown depths of the ocean render them peculiarly inaccessible to the majority of collectors; even the experienced voyager, without some previous knowledge of their habits, would fail to detect any indication of their

presence. As most of them are crepuscular or nocturnal animals, they rarely if ever make their appearance in the bright sun light, but no sooner does the twilight approach, than different species successively come to the surface, and they may then be readily captured in the towing net.

I have appended a chart* showing the different localities where we met with any Molluscs, as I conceive that by collecting and comparing the experience of different voyagers, not only may our acquaintance with the nature of these animals be greatly extended but it may add a link to our imperfect knowledge of the geographical distribution of animal life, a subject, the importance of which, can hardly be overrated.

It is only by comparing a sufficient number of such charts that the facts they convey can be made practical use of ; there are obvious reasons why one voyager may not meet with success in latitudes where another may have been eminently fortunate. Alternation of season, change of temperature, or currents prevailing at different times and places, must greatly influence the movements of these creatures and may often occasion their involuntary migration: again PTEROPODS and other MOLLUSCA may at times be present in abundance without the voyager being able to capture a single specimen. This happens when the speed of a ship exceeds 9 or 10 knots an hour, a circumstance of frequent occurrence on the present voyage, as our ship, an American built clipper, sometimes attained a speed of 15 and 16 knots an hour, when any attempt with the towing net involved immediate destruction of the net, if not loss of the towing line.

The first part of our voyage, which we commenced in the latter part of March, was very stormy, and therefore peculiarly unfitted for the prosecution of any researches in Natural History. We could however watch the "stormy Petrels" following the ship for stray garbage, while an occasional shoal of porpoises or other CETACEA varied the scene by their fantastic gambols; at night the wake of the ship and the crests of the waves shone like luminous vapour, with

Plate No. XII.

here and there brighter specks intermixed. This appearance we afterwards ascertained was partly, if not wholly, caused by multitudes of phosphorescent marine animals, chiefly CRUSTACEA and many of them, microscopic. By the 7th April in Lat. 31·11 N. Long. 17·28 W. the wind having abated, many *Physalias* harbingers of calm weather, floated past, catching the wind by means of their purple crests. Meanwhile we proceeded to prepare our towing apparatus which was simply a bag made of double mosquito gauze of a conical shape as in the accompanying wood-cut Fig. I. It was $1\frac{1}{2}$ foot long, the widest end open and made to fit a circular iron hoop of 8 or 9 inches in diameter, to this was attached 15 or 20 fathoms of cord the size of a ship's log line. This form we found well adapted to use in light winds, but in anything of a breeze it too quickly filled with water which as rapidly regurgitated and carried with it all the contents of the net. To remedy this defect we constructed another net of the form shown in the annexed wood-cut Fig. II. which retained its contents better than the other in windy weather. Macgillivray, Naturalist to the surveying Expedition of H. M. S. *Rattlesnake*, thus describes his net; "not having seen a description of this useful instrument I may mention that the kind used by Mr. HUTLEY and myself consisted of a bag of 'bunting' (used for flags) 2 feet deep, the mouth of which is sown round a wooden hoop 14 inches in diameter. Three pieces of cord a foot and a half long are secured to the hoop at equal intervals, and have their ends tied together. When in use the net is towed astern, clear of the ship's wake by a stout cord secured to one of the quarter boats or held in the hand. The scope of line required is regulated by the speed of the vessel at the time and the amount of strain caused by the partially submerged net." In Darwin's voyage of H. M. S.

Fig. I.

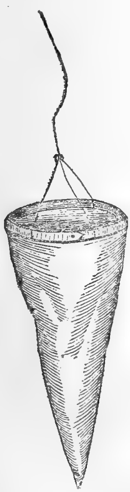


Fig. II.

Beagle he alludes to a towing net of "bunting," but he does not mention how it was kept open. Not having tried a net with a *wooden* hoop, I cannot pronounce on their respective advantages, I observed that with the iron hoop our net was generally half submerged, and it would thus probably have more scope for the capture of specimens than a net with a wooden hoop, which would oftener skim the surface without dipping sufficiently, but the strain was very great with the iron hoop as we not unfrequently lost both net and hoop. We generally examined our net every quarter of an hour as we soon found that when it was left too long, its contents were very apt to be damaged by friction.

On the 8th of April in Lat. 29·32 N. Long. 18·56 W. we made the first trial of the net, but the speed of the ship immediately tore it. For the next two or three days we essayed with nets made of "gunny bag," a kind of coarse brown cloth of open texture, but they retained too much water and owing to the dark color of the cloth it was difficult to see if there was anything in the net; finally we returned to the use of *white* mosquito gauze, the only objection to which was, that it too often required to be repaired or renewed.

April 18th, Lat. 7·6 N. Long. 24·55 W.* At night we passed a few *Pyrosomas*, these animals the most brilliant of noctilucent molluscs, belong to the 6th Class or TUNICATA. They are cylindrical, cartilaginous bodies, 3 or 4 inches long, open at one end, tuberculated, hyaline or almost transparent; they rise to the surface only at night, and although but few were seen on this occasion, yet during a former voyage, when near the same Lat. and Long. our ship for eight successive nights passed through countless thousands of them. They evidently floated a little below the surface, as we could not manage to enclose any in the net, but by means of several large fish hooks tied together and dragged astern we were enabled to secure two fine specimens for examination. When first taken in the hand in the dark, they shone like molten metal, in color a pale but

* It must be borne in mind that the Latitudes and Longitudes mentioned, always refer to the actual position of the ship at noon, but by referring to our course traced on the accompanying chart, our position at any given time may be inferred with sufficient accuracy.

vivid green, but when the animal died it quickly faded. Some authors affirm that each of the tubercles with which their surface is studded, constitutes a distinct animal; but while admitting its compound nature I should feel rather disposed to compare these tubercles or gemmules to the buds on a tree; in short I consider it as one of these remarkable instances where the animal kingdom closely approximates to the vegetable, and is in some measure regulated by the same laws. In their native element they diffuse a strong phosphorescent light for a distance of several inches from their bodies, and their aggregate numbers so illumined the stem of the ship, that moderately large print could be read at midnight.

As we neared the equator a succession of calms temporarily put a stop to our towing experiments, the ship making no perceptible way through the water.

April the 29th in Lat. 22·1 S. Long. 38·7 W. After so many fruitless attempts we were gratified to-night by taking in the net three different species of *Hyalæa* and two specimens of another genus "*Cuvieria*" Fig. 26, the flat *Hyalæa* Fig. 12, was first caught about twilight, the other, Figs. 13 and 14, were taken after dark until 8 P. M. when the wind became too high.

Both of these genera belong to the PTEROPODA, a class the position of which has much distracted the opinions of naturalists, some assigning them a rank second only to the 1st class or CEPHALOPODA, while others have variously considered them superior or inferior to the GASTEROPODA, or degraded them below the level of the ACEPHALOUS bivalve. PTEROPODS being provided with fins can traverse the ocean, a faculty they possess in common with CEPHALOPODS, and in this particular they might be considered superior to the creeping GASTEROPOD, but when we compare their interval conformation, habits and instincts, the GASTEROPOD is seen to exhibit proofs of a much higher state of development than the PTEROPOD, which being destitute of feet or prehensile organs, cannot creep or attach itself to floating objects. Nor is the power of swimming "per se" an indication of high organization, it is in fact possessed by some of the GASTEROPODS

in their earlier stages of existence. I have watched the young of several species of *Cypræa* when first disengaged from the egg or nidamental capsule. The foot of the animal then unadapted for crawling is expanded into two slender fins by means of which these little creatures swim with rapid jerking movements and having little or no voluntary power of directing these motions, they are carried by a blind instinct or rather in obedience to the laws of the great author of nature, wherever they can insure safety from enemies and a sufficiency of their proper sustenance.

I have been much struck with the resemblance the PTEROPOD bears to the rudimentary GASTEROPOD, in its simple organization and in the random jerking manner in which it effects locomotion, apparently with little or no exercise of volition. Their chief use in the animal economy seems to be, to afford food to the whale and to various oceanic birds, most of which being night feeders, the PTEROPODS readily become their prey. It has been already observed that PTEROPODS, with very few exceptions, shun the light. The different species have their regular periods for approaching the surface of the water, where they actively sport about for a given time and then retire from view, to be succeeded by other species which also play their part on the surface and then likewise disappear. The cause or object of these periodical visits is unknown, nor has it been ascertained to what depth they subsequently retire. It may be safely assumed that they never reach the bed of the ocean. In the parts where they chiefly abound, the enormous depth of water would forbid this supposition. Being creatures extremely sensitive to light, it is probable that they merely retire to a depth sufficient to enable them to enjoy the required amount of shade or obscurity, besides which their specific gravity differs so slightly from that of the surface water, that each species when in a state of repose, would probably retain its proper level without requiring the exertion of any voluntary effort.

The *Hyalæas* when placed in a vessel of water, displayed considerable activity, especially the more globose species represented in Fig. 13, which darted about in all directions by rapidly flapping its fins, which in shape were not unlike a butterfly's wings. The shell

was clear as glass, with various patches of pale rust color. The animal was purple and could be seen through the transparent shell. Fig. 14 was a solitary specimen with well marked characters, a small shell of compressed form with the aperture narrowed into a canal, posterior spine somewhat imperfect, color purple. The animal was dead and could not be satisfactorily examined. The flask-shaped *Cuvieria* Fig. 26, when in motion, usually propelled itself in a straight course with the open part of the shell forward. It is provided with fins very similar in form and situation to those of the *Hyalœas* but more elongated. Between the fins is a slight projection which may be the head, but it seemed to me more like a continuation of the mantle or membrane which forms the fins. The shell which is well represented in Fig. 26, is colourless and transparent as the clearest glass; in several of the specimens the rounded extremity of the shell shows marks as though it had formerly been prolonged into a point, which probably becomes deciduous when the animal approaches maturity as is the case with several of the GASTEROPODOS. In the net along with these were several specimens of *Erichthus* and other CRUSTACEA so transparent as to be invisible in water, all except their eyes which appeared like insolated blue specks.

April 30th, Lat. 24·44 S. Long. 37·41 W. this evening about 5½ P. M. in daylight we put over the net and soon got many specimens of a small *Creseis* Fig. 23, the shell is of a spicular form, and longitudinally carinated at one side where the open end of the shell is prolonged into a sharp point. The animal is a PTEROPOD of a pale purple color, they move briskly by means of two fringed fins, between which is a fringed projection or plume, which appears to be a continuation of the expanded membrane forming the fins.

As twilight set in, we caught more of the *Hyalœas* Figs. 9 and 13, already described. The former made its appearance first, and when darker still, the latter species again rewarded our efforts, and it was interesting to observe that each kind was taken at about the same hour as on the previous evening, although we had in the interval sailed a distance of nearly 170 miles. Another PTEROPOD captured this evening was *Cleodora*, Fig. 22, a beautiful hyaline shell,

marked transversely with broad undulating sulci or furrows. The aperture is somewhat triangular and produced into three spines; the shell had but a fragment of the animal adhering to it and was so much mutilated, that I cannot vouch for the representation being quite accurate. A little before 8 P. M. we took in the net two species of *Atlanta* Figs. 6 and 7. The animal is endowed with natatory powers like the PTEROPOD but is possessed of a much more complex organization. It is classed with the GASTEROPODS and has like them a true foot which however is not fitted for progression in the usual manner on a plane surface, but is cleft into two fleshy expansions, which the animal uses very effectively as fins. Attached to the foot is a calcareous operculum, which in Fig. 7, shows very peculiar striæ indicating that the nucleus of the operculum has been situated at the *outer* part of the aperture of the shell, from which the marks of increment proceed in successively increasing wavy lines towards the inner part of the aperture.

It will be seen by a reference to Fig. 7, that the inner whorls of this shell appear as if chambered or divided into septa. This is entirely due to a peculiar joint-like formation of the viscera of the animal, visible through the transparent shell which is in reality unilocular.

The animal has two tentacula and a proboscis, behind which are placed the eyes which do not project externally but are visible under a thin layer of integument. On dissecting out one, and subjecting it to a high magnifying power, I found it to possess a crystalline lens of spherical form, partly imbedded in a black cushiony mass, which appears to serve the purpose of absorbing the rays of light and is somewhat analogous to the *pigmentum nigrum* in the human eye. The magnified eye in its dark chamber is represented in Fig. 7 *a*. The shell is transparent and colorless, discoidal, spiral, in shape not unlike some of the smaller species of *Planorbis*. An expanded keel is attached to the outer circumference of the shell and extends to the space between the last and penultimate whorls, which it connects together. The general form of the shell is extremely elegant. *Atlanta* Fig. 6 of which we obtained only a solitary specimen, is a very remarkable and interesting shell, it is

completely enveloped in a strong membranous epidermis which extends considerably beyond the mouth of the shell and is at its outer edge prolonged into a keel, situated as in Fig. 7, but wholly membranous and only extending over half the circumference of the shell. On the inner whorls the epidermis is marked with spiral dotted lines. The shell is not so flattened in the whorls as Fig. 7, but is, like it, provided with an operculum, otherwise it seems to answer to the description of Sowerby's *Limacina* which he defines as "a thin fragile, spiral, discoid shell, umbilicated on both sides and carinated on the back and below, with a membranaceous lamellar keel," and he adds that it has externally much the appearance of a very diminutive umbilicated *Nautilus*. The *Limacina* however is a true PTEROPOD which this animal is not, it likewise differs from *Limacina*, in the shell being carinated, possessing an operculum, and having the aperture dextral. During the next few days the wind was too high, we got nothing, and our nets were repeatedly torn.

On the 3rd of May, Lat. 30·34 S. Long. 30·51 W. a species of *Loligo* or *Sleeve fish* called by the sailors a flying squid, fell on the deck of the ship. This animal belongs to the CEPHALOPODS the highest class of MOLLUSCA which in their more complicated internal organization, and in the possession of organs of sight and hearing, and a distinct brain, approximate to the VERTEBRATA. The fact of this mollusc having alighted on the deck of the vessel, is remarkable and instructive, for it is alleged that the MOLLUSCA not having members sustained by jointed and solid levers, cannot make rapid springs, whereas it is evident that some have the power of leaping or springing a considerable height out of the water. This fact has been observed by Bennet and others. I have repeatedly noticed other species of CEPHALOPODS that had fallen on the deck of a ship or in the chains and this in calm or moderate weather, so that they could not have been thrown up by the agency of the winds or waves, and I have also been informed by several officers of ships, that they may be often seen to execute a sustained flight, like the flying fish when pursued by its enemies. They are said to accomplish this movement with the head backward and the tail or arrow-shaped extremity advanced, which I

believe to be true, as it is quite in accordance with its mode of locomotion in water. The internal dorsal plate being elastic is probably of service to the animal in making these extraordinary bounds. The specimen above mentioned was about 6 inches long and of a purple color with ten arms or tentacles surrounding the mouth, two of them longer than the others and all furnished with suctorial disks. The general form of the animal was much like that figured as Bank's *Onychoteuthis* and the resemblance also extended to the shape of the elastic dorsal plate but it did not possess the tentacular hooks characteristic of that species.

May 5th, Lat. 30·19 S. Long. 27·40 W. from 5 to 8 P. M. took nothing in the net although the rate of sailing was only from 4 to 5 knots; between 9 and 10 P. M. we got a few *Atlantas*, Fig. 7, and one or two specimens of a small compressed *Hyalæa*, the form of which is well delineated in Fig. 15. The shell when in good condition is perfectly transparent. Habits of animal the same as those already described. This species we afterwards found had a wider range than any of the other *Hyalæas* taken by us during the voyage. In the net with these were some very small globose CEPHALOPODS with prominent eyes and several kinds of small fish and CRUSTACEA. One minute species in particular of the latter class, was of a brilliant blue color. For several successive nights we continued to capture specimens of *Hyalæa*, Fig. 15, and occasionally *Atlanta*, Fig. 7. On the 9th May Lat. 34·4 S. Long. 20·42 W. at 1 P. M. in very calm weather and the sky rather overcast we took in our net another species of *Creseis*, Fig. 24. It differs from the first kind in having no keel to the shell which is also much more elongated posteriorly and the fins of the animal are not fringed. Later in the day we found in the net several specimens of *Glaucus*, a GASTEROPODOUS MOLLUSC of singular form. It has on each side of an elongated body, bunches of digitated filaments, by some supposed to be branchiœ, by others swimming organs. Fig. 27 was the most perfect specimen I could get for illustration. It was about 1 inch long. The structure of these animals is so delicate that when dragged astern in the net they are quickly destroyed by contact with other bodies. All the others when taken from the net had shrunk up into shapeless masses and did

not again resume their natural form. Fig. 28 which is placed here for the sake of comparison, is copied by permission of the Honorable WALTER ELLIOT from his valuable collection of colored drawings of NUDIBRANCH MOLLUSCS. Mr. ELLIOT has suggested to me that my specimen may have lost all the digitated appendages and this seems probable, for the animal in question, though it lived several days in a vessel of water, (thereby proving that the supposed missing organs were not branchiœ) yet it showed no power of swimming or even of moving, beyond curving its body into various contortions when touched. It appears that the species of *Glaucus* are not as yet well determined, which may account for the apparently contradictory statements as to their habits, &c. One author affirms that the *Glaucus* " swims with great quickness," others describe it as being remarkably torpid and sluggish in its movements. *Glaucus*, Fig. 28, which was taken by Mr. ELLIOT, in the bay of Bengal near Vizagapatam, at no great distance from the shore,* differs from my specimen not only in the number of the lateral appendages, but in the form and disposition of the blue lines on its surface. Both species are remarkable for the brilliancy of their color, which is generally attributed to their feeding on the beautiful blue *Velellas* and *Porpitas*, animals very low in the scale of animate objects, which are met with abundantly in these seas. This conclusion appears to me illogical. Most of the Pelagic animals we met with, were remarkably devoid of color, and such as had any were generally blue. Indeed with the exception of an occasional tinge of purple, I do not remember that we met with them of any other tint; so that I think we must look elsewhere for the cause of this color prevailing so remarkably in Pelagic and other marine animals. It seems to me not improbable that Iodine,a powerful coloring agent, universally prevalent in sea water, may be partly instrumental in producing it.

May 21st, Lat. 40·51 S. Long. 24·57 E. After dark we took in the net myriads of minute CRUSTACEA not much larger than cheese mites, of a pale blue color, and in the dark

* The perfect specimens of this *Glaucus* when first captured moved with considerable rapidity. The branched appendages appeared to be very brittle and were easily broken when attempting to catch the animal—W. E.

a mass of them appeared like liquid fire of a bluish yellow color. Most of the CRUSTACEA we have caught are luminous, especially their eyes. After 9 P. M, we caught in the net three small *Hyalæas* one of them, Fig. 15, already described, the other kind delineated in Fig. 16, had a more expanded aperture and the posterior extremity was unusually lengthened and curved so as to give the shell somewhat the form of a cornucopia. Another interesting shell of which we obtained several specimens this evening, much resembled a minute sinistral *Helix*, transparent, glossy, discoidal, with the spire slightly elevated ; it is well represented and magnified in Fig. 8. I could not well distinguish the animal. It was extremely minute and none of those I placed in water showed any signs of vitality. I believe the shell to be a *Limacina* or *Spiratella.* These names are by some authors considered synonymous, though others take them to represent two different genera. The shell has likewise been confounded with *Atlanta* ; and consequently the various descriptions of this shell, are most conflicting and contradictory. On this account I regret the more, my not having been able to record the appearance of the animal. However the figures of this and indeed of all the species illustrated in the accompanying plates are executed with such fidelity as to render it a comparatively easy task for a Naturalist in command of the requisite means, either to pronounce a species new, or to identify it with such as have been already described. The animal is probably a PTEROPOD. We took a few more specimens of it, the following night, after which we saw no more of them.

Our course was now south easterly for a considerable time, during which our experiments with the net were almost barren of results, and it was not until we approached higher and warmer latitudes, that we again fell in with MOLLUSCA. However, hardly a day passed that our net did not reveal varied and novel forms of animal life, with which the ocean seems to be teeming,—beautifully marked fish, singular CRUSTACEA and a variety of ACALEPHÆ, as *Beroe, Diphyes* and *Cuboides,* the two latter perfectly transparent and angular, like animated crystals. Many of these animals would live for days when placed in a vessel of sea water and the study of their habits in this manner, was always interesting and well calculated to while away a vacant hour.

June 3rd, Lat. 31·25 S. Long. 84·15 E. We took in the net several *Creseis* of a different form from those we had hitherto met with, the posterior part of the shell terminating in a curved point. This is shown in Fig. 25. Fig. 25 *a.* shows the position of the shell when the animal is in motion, which it effects much in the manner of those already described except that the convexity of the curve is always directed backward, in this respect resembling the *Hyalæas.* And I may here observe, that some authors consider *Cleodora*, (of which *Creseis* and *Cuvieria* are by them reckoned only sub-genera) so closely allied to *Hyalæa*, that it is impossible to draw the line between them, and in support of this anology they advert to the fact, that the animals, in their internal structure, differ but little from each other. Now although the analogy is undoubted, yet the differences seem sufficiently marked to warrant the present arrangement of genera and even species, at least the analogy is not stronger than that observed among other MOLLUSCS, the anatomical distinctions between which, are almost imperceptible, and yet they have been established into species and genera by the common consent of Naturalists. It is worthy of observation that the three species of *Creseis* were all captured in daylight, only one species, Fig. 23, having been ever taken by us at night. In this respect they contrast remarkably with the *Hyalæas* which, as far as we could ascertain, are strictly nocturnal or crepuscular animals. We continued working at the net all day, but were not successful in getting any more of this species until 7th June, Lat 26·0 S. Long. 87·9 E. *a little after* 12 *o'clock noon,* when we took two or three specimens alive. In the evening a little after dark we got two specimens of *Hyalæa* Fig. 9. This species much resembles *Hyalæa* Fig. 12 but differs from it in the direction of the lateral spines. It is also considerably larger. The animal has the power of withdrawing entirely into its shell, but often when at rest it kept its fins extended as in Fig. 11 ; when in motion the triangular membrane observable between the fins in the above figure was doubled over the aperture of the shell as represented in Fig. 10, the dark blotches are the viscera of the animal as seen through the shell. In the net with these we found a *Hyalæa* Fig. 17, differing from any previously met with in being more angular in form and in having the anterior part of the shell deeply grooved horizontally;

color white or nearly transparent; animal slightly tinged with purple; habits, so far as can be observed, do not appear to differ from those of the *Hyalæas* already described. On this evening we also obtained several *Cuvierias*; a genus we had not met with since April 29th in Lat. 22·1 S. Long. 38·7 W; all these were taken before 8 P. M.

9th June, Lat. 22·40 S. Long. 84·27 E. a little before 5 P. M. we took from the net several *Cuvierias* and one *Hyalæa*, Fig. 12. This species of *Hyalæa* we have always got earlier than any other but never before in daylight as on this occasion, which was half an hour before sunset: later this evening we got no more PTEROPODS but great numbers of *Atlanta*, Fig. 7, already described, and a considerable number of a GASTEROPODOUS MOLLUSC "*Ianthina exigua*" the characteristic striæ of which are well shown in Fig. 3. Most of them were empty shells and none had the animal alive.

On the following evening about 6 P. M. in Lat. 21·5 S. Long. 83·46 E. we got a few more *Ianthina exigua* in a similar condition and with them two *Cuvierias* and a few specimens of *Hyalæa*, Fig. 12. For the next few days we met with tolerable success but got nothing new.

On the 16th June in Lat. 4·32 S. Long. 80° 4 E. a little before 8 P. M. we took in the net a species of *Hyalæa*, Fig. 18, somewhat resembling Fig. 13, but more globose and with its spines less developed. The most part of the shell is transparent and colorless, but the anterior surface is claret colored deepening in color towards the aperture; animal nearly white with a tinge of purple; mode of progression similar to those already described.

June 17th, Lat. 2·15 S. Long. 79½ E. at dusk we caught in the net several small *Cleodoras* about a quarter of an inch long triangular, wedge-shaped and pointed as represented in Fig. 20. The animal is of a pale milky color and moves actively by means of its two expanded fins, between which is visible a slight projection which appears like a head; with these we found several *Atlantas* and a *Hyalæa* similar to that obtained on the previous evening. Later in the evening when quite dark, we took in our net two specimens of a brown *Hyalæa*, Fig. 19, which I am not prepared to say is specifically distinct from Fig. 13, as a difference in locality is known

to produce such remarkable aberrations in species; it is however more elongated in form, and its lateral spines are less produced. Its deep brown color is worthy of note among shells most of which are of glassy transparency. In the net with these were several specimens of *Ianthina exigua* and three or four *Cleodoras*, larger and of a more elegant and curvilinear form than the last. Their general appearance is well depicted in Fig. 21. The animal is provided with two alar appendages of considerable size and moves rapidly.

June 18th, Lat. 1.12 S. Long. 78·44 E. This evening just before dark many specimens of *Ianthina fragilis* floated by the ship. What first attracted our attention was the *dead white* appearance of their vesicular floats which we could thus readily distinguish from the particles of foam caused by the motion of the ship, we soon captured in our net a considerable number of them in very perfect condition, [see Fig. 4.] the shell is covered with a very delicate epiderimis the animal when handled exudes a purple stain; when in a state of repose on the surface of the water the shell is entirely submerged the float only being above the surface except that it occasionally raises its proboscis and mouth armed with numerous slender curved teeth visible to the naked eye; the float is attached to the foot of the animal from which it could be readily detached or peeled off, apparently without injuring the animal. Most of the specimens taken were the *I. fragilis* but among them were three examples of the *Ianthina globosa* Fig. 5. This shell is in color a deeper blue and it wants the carinated form of *I. fragilis.* The floats of these molluscs have been repeatedly described and commented upon by authors. It was observable that the float of *I. globosa* was more loosely constructed and of a more irregular form than that of *I. fragilis.* One of the former had the lower part of its float studded with egg capsules, having the appearance of a cluster of small pendulous blue vesicles, each of which, when examined under a microscope, was found to contain numerous minute ovules of a pale blue color. Shortly after 8 P. M. we got several additional specimens of *Cleodora*, Fig. 21 and about 9 P. M. a small specimen of *Argonauta*, Figs. 1 and 2—not the *Argonauta argo*, but an allied species of a horn color, having a broader keel and fewer tubercles. The animal belongs to the CAPHALOPODA, already mentioned as the highest class

of Mollusca approaching in their physical conformation and instincts to the VERTEBRATA. This superior intelligence was exhibited by the animal in question. When taken out of the towing net it had artfully folded its limbs over the shell so as to resemble a nodulous mass of brown sponge, which indeed I at first supposed it to be, but when placed in a tumbler of sea water and left undisturbed, it cautiously began to creep about the bottom of the tumbler, head downward, it then repeatedly darted against the sides of the tumbler and while doing so, it often changed color rapidly from pale brown to dark purple, apparently with the double object of concealment and escape. In swimming the animal effected locomotion not only by the rapid contraction and expansion of its arms but by the forcible expulsion of water through its syphon. The tubular extremity of the syphon is seen in Fig. 1. At the approach of death the animal underwent some convulsive movements which appeared to disengage it from its shell, after which it ceased to move and quickly died; another specimen taken on the following evening exhibited precisely similar phenomena when dying. Naturalists were long divided as to what animal was the true possessor of the *Paper Nautilus*, some throwing doubts on the CEPHALOPOD being the original inhabitant of the shell. Even at the present day authors are at variance upon this point, some even asserting that the *Argonaut* is not a shell but merely an envelope for containing the eggs of the CEPHALOPOD found in it. This scepticism in the public mind appears the more extraordinary, from the well established fact, that this animal (and no other) has been found in this shell in all various stages of growth, as has been fully proved by the interesting experiments of Madame Power. Professor Owen has also demonstrated that the *pearly Nautilus* and other allied shells, recent and *fossil*, appertain to CEPHALOPODS. Much more might be adduced to prove that this animal is the legitimate owner of the shell but it has already been done by abler hands. However I conceive that as the matter stands at present, every circumstance should be noted that may tend to remove obscurity, either by imparting new facts or by corroborating those already recorded.

Our voyage was now near its close and notwithstanding that we continued to ply our nets assiduously, we did not succeed in cap-

turing any more MOLLUSCA, although many interesting forms of CRUSTACEA rewarded our efforts, a description of which is hardly within the scope of these pages, which however, I trust, have sufficiently shown, how the monotony incidental to a sea voyage may be relieved by giving attention to Zoology, facilities for which present themselves much oftener than might be imagined by those who have not practically pursued such investigations.

References to plates IX., X., XI. *and* XII, *illustrating Mr.* TRAILL'S *paper.*

[We had hoped to receive a synoptical table of the species collected by Mr. TRAILL, but as he finds himself unable from the want of books of reference to assign the trival names of the several specimens or to pronounce with certainty which of them may be considered new, the following list has been added to facilitate references to the Plates.]

PLATE IX.

Genus ARGONAUTA.

Dorsal arms (of the female) webbed at the extremity, secreting a symmetrical involuted shell. *Mantle* supported in front by a single ridge on the siphon.

Fig. 1. Animal of *Argonauta sp.*? detached from the shell. Color light brown or horn color with crimson spots.

Fig. 2. The Shell.

a. Front view.

b. Lateral view.

All of the natural size.

Genus IANTHINA.

SHELL thin, trochiform; *nucleus* minute, sinistral; *aperture* foursided: *column* tortuous; *lip* thin, notched at the outer angle; *color* violet at the base becoming white on the spire.

Fig. 3. *Ianthina exigua* (magnified).

The small figure shows the natural size.

Fig. 4. *I.* ——— *fragilis.*

Fig. 5. *I.* ——— *globosa.*

Genus ATLANTA.

SHELL minute, glassy, compressed and prominently keeled; *nucleus* dextrally spiral; *aperture* narrow, deeply notched at the keel; *operculum* ovate, pointed.

Fig. 6. *Atlanta* ——— (magnified).

The small fig. shows the natural size.

Fig. 7. *Atlanta* ——— (magnified.)

The small figures show the natural size.

a. With the animal, exhibiting the bifid foot employed in swimming.

b. The eye magnified.

Genus LIMACINA.

SHELL subglobose, sinistrally spiral, umbilicate ; *umbilicus* margined ; *operculum*, none.

Fig. 8. *Limacina ?* —— (magnified) front and lateral view.

PLATE X.

N. B.—The large figures represent the shell magnified—the smaller ones the natural size.

Genus HYALÆA.

SHELL globular, translucent ; dorsal plate rather flat, produced into a hood ; *aperture* contracted, with a slit on each side ; posterior extremity tridentate.

Fig. 9. *Hyalæa*——.

Fig. 10. The same showing the animal with its alar appendages in a state of rest.

Fig. 11. The same showing the appearance of the animal when in motion.

Fig. 12. *Hyalæa*——.

Fig. 13. *Hyalæa*—— : Quite transparent, with rust-colored patches ; animal purple.

Fig. 14. *Hyalæa*—— : Shell compressed, animal purple.

Fig. 15. *Hyalæa*——.

Fig. 16. *Hyalæa*—— : Shell with posterior extremity elongated, curved, aperture more expanded.

Fig. 17. *Hyalæa*—— : Shell deeply grooved, and purplish.

Fig. 18. *Hyalæa*—— : Shell globose, claret colored.

Fig. 19. *Hyalæa*—— : Shell of a deep brown color.

PLATE XI.

Genus CLEODORA. SHELL pyramidal, 3 sided, striated transversely ; *aperture* simple ,triangular, with the angles produced, apex acute..

Fig. 20. *Cleodora* —— : (magnified) *shell* triangular elongated, wedge shaped, pointed ; animal of a pale milky color.

Fig. 21. *Cleodora*——: (magnified) *shell* triangular, compressed.

a. Front view.

b. Posterior view.

c. Section of aperture.

d. Natural size.

Fig. 22. *Cleodora*——: double the natural size; *shell* hyaline, with broad undulating transverse sulci.

a. Lateral view.

b. Front view.

c. Transverse section at the aperture.

d. Natural size.

Genus CRESEIS,

SHELL as in *Cleodora* but slender, conical, straight or curved

Fig. 23. *Creseis*——: (magnified) *shell* elongated, carinated, pointed, straight; *alæ* of the animal fringed.

a. With the animal as when swimming; natural size.

Fig. 24. *Creseis*——: (magnified), appears to differ little from Fig. 23, *alæ* of the animal rounded, simple.

a. With the animal, natural size.

Fig. 25. *Creseis*——: (magnified) *Shell* curved at the point.

a. With the animal, natural size.

Genus CUVIERIA.

SHELL cylindrical, transparent; *aperture* simple, ovate; apex acute in the young, afterwards jointed and often deciduous.

Fig. 26. *Cuvieria*——(magnified).

a. With the animal, natural size.

Genus GLAUCUS.

Animal elongated, slender; *foot* linear, channel-led; *tentacles* four, conical; *branchiæ ?* supported on 3 pair of lateral lobes.

Fig. 27. *Glaucus*——: natural size. Taken 34 S. Lat. 20 W. Long.

Fig. 28. *Glaucus*——: natural size. Taken near the shore 17·42 N. Lat. 83 W. Long.

PLATE XII.

Chart of the track of the American Clipper *Blue Jacket* showing the localities at which the different specimens of *Molluscs* as indicated by their numbers, were captured.

III. *On a Photographic Printing Process. By Captain* TRIPE, *12th Regt. N. I.*

[This paper which was read at the Meeting of the Photographic Society, has been received from the Secretary to that Society, for publication in the Journal.]

BANGALORE, *22nd September*, 1856.

GENTLEMEN,—I have much pleasure in laying before you this paper which Dr. SCOTT will read to you. There is a value in the Printing process, that I am about to describe which, coupled with the fact, that I do not obtrude on you uninvited, will acquit me of presumption in doing so.

My facilities for acquiring experience in this branch of the art, have been great, and there are few, to whom this will be read, who have the requisite leisure, to practice the various processes, from time to time put forward, and so decide for themselves, which would be the *simplest*, as to manipulation, the *safest*, as to permanence, and the *best*, and *most certain*, as to results. I have followed many methods—and, keeping in mind all their several advantages, I have no hesitation in recommending for your use, though it is by no means, the *simplest* in manipulation, a Process published by Mr. SUTTON of Jersey, in which Hyposulphite of Gold is used as a toning agent. The Council of the Society are, I believe, about to notify the opening of an Exhibition to be held at Madras during February next, and, as it is only through *successful Printing*, that the Photographer's skill is properly represented, *this* may be no inappropriate occasion to bring to your notice a process, not as yet generally followed, but which will show itself *superior*, it is to be hoped, over " *Old Hypo*" at the forthcoming Exhibition.

Thin French negative Paper, albumenized, is what I find best for my purpose. To albumenize, use

10 oz. Albumen,
20 oz. Dist. Water,

300 grs. Muriate of Ammonia,
240 grs. Sugar-candy.

Float the paper on this for half a minute. Hang up and dry—Ironing this paper before sensitizing seems quite unnecessary.

To sensitize use,

60 grains Nitrate of Silver,
12 minims Acetic Acid,
1 oz. Dist. Water.

Float it on this for 4 or 5 minutes—hang up to dry.

Expose in the pressure frame until the lights are a shade or two darker than they ought to be in the finished picture. When printed sufficiently—wash all traces of the aceto-nitrate out of the paper—in a darkened room. Dissolve off the Albuminate of Silver in a bath of Hyp. 1 to 8 of water, or of liquor Amm. 1 drachm to 1 pint of water, in the former about 8 minutes—in the latter the action is more violent and practice only will enable the operator to judge of the time.

The Print must be well washed after this bath and then immersed in the toning bath composed of

10 grains Chloride of Gold,
30 oz. Distilled water,
30 grains Hyposulph. Soda,
30 minims of Hydrochloric acid *if* the chloride of Gold be *neutral.*

Mix the Gold and the Hypo. each in 15 oz. of water, and pour the former into the latter gradually stirring the white. Then add the acid if necessary.

Keep the picture in this, till the shades are a deep purple, and the lights, a pleasing grey. Then pass through water—(not for more than a minute or two as the lights are yellowed by longer washing,) into the second fixing bath of Hypo. 1 to 8 of water to ensure its perfect fixation. It should remain in this from ten to fifteen minutes. Wash as usual.

A good method of washing is to take up a dishful of pictures (8 or 10) and let them drain on a piece of plate glass slanted, for a minute or two, then lay it flat and with a glass roller express the liquid from the papers as well as you can, replacing the mass in a dish of fresh water and let them separate of themselves which they will do after some shakings of the dish. This should be done after a few washings after fixing—and repeated once or twice—during the changing of water which ought to be every quarter of an hour for twelve hours or so.

Memo.

Throw down the Nitrate of Silver in the first washings—great saving of the silver salt will result from this.

The same economy can be practiced with regard to the toning bath—by recovering the unused gold.

I have found that 1 grain of Chloride of gold tones three pictures 14 × 12.

It would be economical to make Chloride of gold for oneself—a half sovereign will give 86 grains of Chloride—and the cost will be about 6 Rs.

Put the half sovereign into a glass stoppered bottle and pour upon it six drachms of Aqua Regia—made of

$$\left.\begin{array}{l}1 \text{ part nitric} \\ 5 \text{ ,, mureatic}\end{array}\right\} \text{acids,}$$
6 ,, water.

Let it dissolve gradually adding acid when necessary. When dissolved dilute, and throw down the gold by protosulph. iron (6 to 1 of gold)—

Re-dissolve (after thorough washing) and evaporate on a water bath.

A convenient form of drying apparatus can be made by two sticks 12 feet long 3 inches broad and $1\frac{1}{4}$ thick slanted against a wall—long (according to the wishes of the Photographer) rods squared and veneered with deal or other soft wood should have their

ends lodged in squared hooks at intervals of 10 inches on the sticks —the rods fitting the hooks—I have on a space of wall 12 feet long dried 143 papers almost daily for months and find it most convenient.

In conclusion I would mention what seem to me to be the advantages of the Process I have described.

First.—The saving of time in not overprinting as required by the old Hypo. processes.

Second.—The agreeable tone of the picture—its firmness and the preservation of its half tones.

Third.—The comparative certainty of its working.

Fourth and most important.—The permanence. Prints sulphuretted have been proved to be not so safe from fading as Prints coloured by Gold. In this Process the toning is by Gold only—and with subsequent care in washing this seems to be as safe as Photographic Printing can be.

I must not close without reminding you that nearly all of this is given in Photographic works—and that I am merely bringing the subject to your notice that you may benefit by it as I have done.

The subjoined Table of "Formulæ for preparing Albumenized Paper," was communicated by Captain J. D. Scott, of the Madras Artillery.

"Similar Tables" he observes "might be drawn up for the "Fixing and Toning Baths" &c. &c.

"In England 1 Egg gives an ounce of Albumen, but in this country, when the Eggs are very much smaller, I find that 24 Eggs give about 16 ounces of Albumen, i. e. $1\frac{1}{2}$ Eggs are required to give 1 ounce."

FORMULÆ FOR PREPARING ALBUMENIZED PAPER.

Number.	Name of Operator.	Albumen.	Distilled Water.	Chloride of Soda.	Muriate of Ammonia.	Muriate of Baryta.	Iodide of Potassium.	Time to float on Solution.	To Excite. Nitrate of Silver.	Water Dis.	Glacial Acetic Acid.	Time to float on solution.	Authority.
		Ounce.	Ounce	Grains	Grs.	Grs.	Grs.		Grains	oz	Ms.	Mins.	
1	Horne......	1	1	20 or	20	0	0	A few minutes	40	1	0	10	Thornthwaite's "Guide to Photography," 9th Ed. page 66
2	Dr. Diamond	1	1	5	5	0	0	3 or more ,,	40	1	0	3 to 5	"Notes and Queries" for 1853
3	Delamotte .	1	1	20	0	0	0	3 or 4 ,,	60	1	0	4 or 5	"Practice of Photography" 3rd Ed. page 53.
4	Pollock.....	4	1	100	0	0	0	4 ,,	90	1	0	......	London Photographic Journal Vol. 1 page 85
5	Lyte.... ..	1	1	0	0	72½	0	5 to 10 ,,	120	1	0	......	Do. Vol. 1 page 116
6	Spencer	1	1	16	0	0	0	1 to 10 Secds.	90 or 100	1	0	A few	Do. Vol. 1 page 204
7	Hardwich...	⅓	1	15	or 15	0	0	1 Minute ...	60	1	0	3	Photographic Chemistry, 2nd Ed. page 197
8	Hennah	1	1	0	32	0	1	1 ,, ...	50	1	2	2 or 3	"The Collodion Process" 4th Ed. page 51
9	Long.... ..	1	drs. 2	5	0	0	0	3 ,, ...	50	1	0	......	"Practical Photography" page 46
10	Highley	1	1	240	0	0	0	2 or 3 ,, ...	120	1	0	......	Journal Microscopic Soc. 1853, page 191
11	Cundall.....	8	10	Sat Sol 6 drs. (a)	0	0	0	2 ,, ...	60	1	0	......	"Photographic Primer" page 26
12	Sutton....	Whites of 2 doz. Eggs.	10	480	0	0	0	10 Seconds....	ounces 2½	20	drs 4	5	"Calotype Process" page 53
13	How.	1	1	12	0	0	0	5 to 10 Minutes	50	1	0	3	"On the Production of Positive Proofs" page 9
14	Howlett	1	1	40	0	0	0	1 ,,	60	1	0	1	"Howlett on Printing" page 8

N. B. The Salt is to be dissolved in the water, then add the Albumen—then with a bundle of Quills tied together beat the whole into a *perfect* froth—allow it to stand for several hours and subside—then pour into a Tray for use.

(a) And acetic acid 51 Minims.

IV. *Entomological Papers, being descriptions of new Ceylon Coleoptera with such observations on their habits, etc., as appear in any way interesting. By* JOHN NIETNER, *Colombo, Ceylon.*

No II.

[N. B. In No. I. species 1 to be cancelled, being synonymous with *Chlænius nitidulus*. Dej.

Spec. 2. ditto: syn. *C. xanthophilus*. Wieden.]

TRIB. LEBIIDÆ.

Anchista. n. g. N.

Corpus depressum, ovatum. Mentum dente magno obtuso, lobis parum breviore, his extus rotundatis, apice acuminatis. Palpi robusti, maxillares art. ultimo magno ovato, apice obtuso, labiales art. ultimo valde securiformi. Ligula cornea apice obtuse acuminata, labri marginem anteriorem attingens. (Paraglossæ mihi non dissectæ.) Labrum transversim quadratum. Mandibulæ simplices apice arcuatæ et acuminatæ. Antennæ robustæ art. 1º mediocri, 2º brevi, 3º quarto paulo longiore, 4-10 subæqualibus, 11º penultimo parum longiore. Thorax longitudine latior, angulis anticis rotundatis, medio obsolete angulatus, basi angustatus, angulis rectis. Elytra apice quadrate truncata. Fedes robusti tarsis art 4º profunde bilobo, unguibus fortiter pectinatis.

12. *Anchista modesta. N.*

A. brunneo-testacea, elytris (maculis 2 obsoletis subhumeralibus exceptis) obscurioribus abdomine piceo. Long. corp. 4 lin.

Caput fronte medio leviter uni-impressa. Thorax linea media longitudinali divisus. Elytra apicem versus parum dilatata, striato-punctata, ad striam 2^m punctis 2 majoribus subapicalibus, cum thorace marginata.

Prope Colombo nocte ad lumen cepi.

The characteristics of this new genus are those of the g. *Calleida* (between which and *Cymindis* I place it) excepting the ligula which

in this case is obtusely acuminated, the last joint of the maxill. palpi which is obtuse at the apex and the thorax which is not as in *Calleida* longer than broad but the reverse. From *Cymindis* it would differ principally in the deeply bilobed 4th tarsal joint, and in some other minor points, but it is difficult to say what the true characteristics of this genus (which appears for this reason to require a careful revision) are, if even Lacordaire uses the particle "ou" not less than five times in the diagnosis he gives of it in his g. d. Col. However, I feel justified in separating *Anchista* from *Cymindis* as well as from *Calleida*. The name "*Anchista*" has reference to the affinity of the insect to the two genera just mentioned, whilst the specific name "*modesta*" refers to its inconspicuous colors. Amongst its peculiarities weight ought to be laid upon the plumpness of the palpi, in fact all other parts of the mouth and even the whole head, which was very striking to me.

Like many of my best CARABIDÆ I found this insect at night on the table whither it had been attracted by the light, I may mention that the single specimen which came thus into my possession has an oblong shallow impression on either elytron, perhaps accidental, perhaps a peculiarity. The anterior tarsi are dilated and furnished with hairy brushes below, longest at the apex of the lobes of the 4th joint.

Elliotia. n. g. N.

Corpus subconvexum, ovatum. Caput mediocre, oculis maximis. Mentum leviter transversim emarginatum, edentatum, lobis acuminatis. Ligula sub-membranacea apice truncata, paraglossis connatis marginem anteriorem parum superantibus, obtusis. Palpi elongati, art. ultimo elliptico, acuminato. Labrum magnum transversum, integrum, mandibulas, fere obtegens. Mandibulæ validæ, edentatæ. Antennæ robustæ, filiformes, humeros superantes, art. 1° mediocri, 2° brevi, 3° quinti prope longitudine, 4° præcedente breviore, 2-4 obconicis, 5-10 æqualibus, cylindricis, 11° præcedente tertia parte longiore, 4-11 pilosis. Thorax parvus, capite minor, transversus, longitudine duplo latior; antice leviter emarginatus, lateribus elevato-marginatus, ab apice ad medium lateribus rotundatus, medio fortiter angulatus, a medio ad basin valde abrupteque

angustatus, basi truncatus, subtus cylindricus. Scutellum leviter excavatum. Elytra ovata, marginata, apice sat fortiter truncata. Pedes omnes subæquales, simplices, tenues, tarsis cylindricis art. 3-4 magis minusve trigonis, unguibus simplicibus. Prosternum carinatum.

In honorem Dom. Hon. Walteri Ellioti (Madaraspatani), naturalistæ diligentissimi, meritissimi, nomen imposui.

13. *Elliotia pallipes. N.*

E. supra nigra -nitida, thorace scutelloque rufo-testaceis, labro elytrorumque limbo atque sutura brunneo-testaceis; subtus piceus, pectore rufo-testaceo, pedibus albidis, his geniculis oreque (palpis obscurioribus exceptis) testaceis. Long. corp. $2\frac{1}{4}$ lin.

Caput ad antennarum insertionem et inter oculos utrinque profunde impressum. Thorax basi rugosus, ante medium utrinque uni-impressus, linea media longitudinali divisus. Elytra punctato-striata, infra humeros leviter impressa.

In ripis lacus Colombensis sub veget. putrescent. mens. Jul. non infrequenter legi. Agilis est et avolare semper expeditus.

A pretty and very interesting little insect, about whose systematic position I am not quite satisfied, however I provisionally place it towards the end of the true LEBIIDÆ. I find it most to agree with the descriptions of the g. *Pentagonica* S. G. and *Rhombodera* R. with neither of which, however, it is identical. The head is distinguished by the large and prominent eyes and four deep impressions, two larger ones at the root of the antennæ, two smaller ones between the eyes, also by a very distinct neck which connects it with the thorax; the labrum is large, transverse and entire with the angles rounded off and the base narrowed; the mentum is but slightly transversely emarginated, edentate; the ligula is truncated at the tip, the paraglossæ adhere to it, reach a little beyond it and are obtuse at the apex; the palpi are rather long with the last joint elliptic, acuminate; the antennæ are strong, filiform and reach beyond the shoulders, joints 5-10 are of equal length and cylindric, 4-11 are pilose. The most remarkable part of the insect is, however, the thorax which is of a sub-rhomboidal shape, trans-

verse, smaller than the head, as broad again as long, it has two strong lateral angles at the middle, each furnished with a strong bristle, the anterior part has the sides rounded, the posterior abruptly obliquely contracted, at the base it is cylindric. As a specific distinction of the thorax I mention moreover, that in the present species, it is impressed with two deep punctures before the middle and that it is rugose at the case. The abdomen is slightly peduncled. The scutellum is slightly excavated. The elytra are oval, rather convex and impressed with rows of punctures. The legs are simple and weak, apparently equal in both sexes. The anterior tarsi are a little stouter than the rest, but not dilated nor furnished with any additional clothing below, the anterior tibiæ are deeply notched. As to the color: the head and wing-covers are black, the latter with the suture and margin of a light brown and highly polished, the thorax is reddish and the legs are whitish. The insect is very agile and ever ready to take to its wings. It is of quite a peculiar appearance, imparted to it by its large eyes, small curiously shaped thorax and rather plump elytra and abdomen. I may further mention that I have observed the 4th joint of the maxillary palpi to collapse when the specimens become quite dry, so as to give them a different, spoonlike, appearance apt to mislead any one who has not examined fresh specimens.

14. *Harpalus advolans. N.*

H. æneus, clypeo, labro, antennis mandibulisque brunneis, his apice nigris, subtus testaceus, lateribus obscurior, pedibus flavis, tarsis geniculis spinulisque brunneis, ore testaceo. Long. corp. $4\frac{3}{4}$—$5\frac{1}{4}$ lin.

Caput læve. Mandibulæ unidentatæ. Palpi art. ultimo elongato, apice truncato. Menti dens simplex, obtusus. Ligula apice quadrate truncata, angulis acutis leviter productis, paraglossis inflatis marginem anticum parum superantibus. Thorax longitudine sesqui latior, dorso anticeque lævis, basi rugoso-punctatus, 2-impressus. Elytra striata, cum thorace anguste marginata, Variat colore testaceo-ænea.

Nocte ad lumen, sed adhuc non usquam alibi, non infrequenter cepi.

I have taken this species not unfrequently at night on my table but have never found it anywhere else as yet. It is not very remarkable, for which reason I have mentioned the parts of the mouth in the description, these being moreover not very constant in this genus. The insect is of the usual oval, *Harpalus*-form, of a dark metallic green on the back and more or less yellowish or light brown below, the color of the back changing occasionally to a brownish green.

15. *Oodes piceus. N.*

O. ovatus, subconvexus, piceus, tarsis, palpis antennarumque articulis 3 primis castaneis, palpis apice flavis. Long. corp. 4 lin.

Caput parvum, inter antennas linea latitudinali abbreviata impressum. Labrum integrum, punctis 3 impressum, puncto intermedio bi-lateralibus uni-setigeribus. Mandibulæ validæ prominentes. Palpi art. ultimo elongato-ovato, apice leviter truncato. Menti dens apice truncatus leviterque sinuatus. Antennæ art. 3° quarto æquali nisi paulo breviore. Thorax amplus basi elytris applicatus, apicem versus angustatus, angulis posterioribus subdepressis translucentibus, ante scutellum leviter sinuosus, ante sinum obsolete latitudinaliter impressus. Elytra striata, cum thorace angustissime marginata. Pedes validæ, ant. tibiis apice intus uni—,intermed. et post. bi-calcaratis.

Specimen singulum f. in ripis lacus Colombensis sub vegetab. putrescent. legi.

As already one species with a bifid mentum tooth (*O. pulcher*) has been received in this genus I have waived the hesitation I should otherwise have felt to refer to it the present one, the tooth of which is of a similar description. I have not seen the *O. pulcher*, but as it is said to be an inhabitant of this part of the world it may possibly be identical with my species. If not, they might, as the g. is otherwise pretty constant in its characteristics, be separated under a new name as types peculiar to India. Besides the abnormal mentum tooth the insect has not much to distinguish it from others of the genus. The labrum is, however, peculiar being entire, or even very slightly produced in the middle, with the angles rounded off, it is impressed near the anterior margin, with three deep punc-

tures, the central one of which is furnished with two—the lateral ones with one strong bristle each. The anterior tibiæ are but slightly notched. The prosternum is largely developed, reaching beyond the anterior coxæ, obtusely acuminated and received in a deep excavation of the mesothorax. But I doubt that the development is sufficiently large to entitle the insect to a place in the g. *Lonchosternus* Laf. which however I have not seen in nature.

16. *Trichopteryx cursitans. N.*

T. ovata, subconvexa, pubescens, supra obscure ænea, elytris æneo—brunneis, subtus picea, pedibus oreque testaceis, antennis art. 3-11 nigrescentibus. Long. corp. $\frac{2}{5}$ lin.

Antennarum clava art. 2 primis ovatis, ultimo conico, acuminato. Thorax amplissimus, elytris tertia parte minor, convexus, angulis acutis, basi humeros amplectens, apice angustatus. Elytra subdepressa, subquadrata, apicem versus parum angustata, truncata, abdominis 3-4 segmenta ultima non obtegentia. Tibiæ medio incrassatæ. Coxæ posticæ maxime dilatatæ. Mesosternum carinatum.

Sub veget. putrescent. exsiccescentibus in prov. occid. copiosa.

A rather large species commonly met with in this part of the Island under rotting vegetable substances somewhat dried up. It is very agile and ready to take to its wings which are of the beautiful typical construction, about twice the length of the body and in dead specimens frequently produced behind. These insects vary a little as to shape, some being more narrowed behind than others, and also as to the exact number of the abdominal segments left uncovered by the elytra. The head is large but exhibits nothing abnormal or extraordinary; the thorax is very large, emarginated in front and behind, with the angles acute, the basal ones enveloping the shoulders; the wing-covers are subquadrated with the angles rounded off and a little narrowed behind; the legs have the tibiæ incrassated in the middle and the posterior coxæ very much dilated and distant from each other, in all other respects they are typical. The shape of the body is that of an egg, broadest at the shoulders, gently narrowed towards the apex of the abdomen, and rounded off towards the head.

17. *Trichopteryx immatura. N.*

T. præcedenti similis, differt tamen colore supra æneo-testacea subtus testacea, antennarum art. 3-11 nigrescentibus; differt etiam, corpore crassiore, magis quadrato, capite paulo majore, thorace minus convexo, parum ampliore, elytris abdomen totum vel fere totum obtegentiis. Pedes, antennæ etc. omnino præcedentis. Long. corp. $\frac{1}{3}$ lin.

In præcedentis societate specimina nonnulla legi.

Of somewhat the appearance of an immature individual of the former but sufficiently distinct to be formed into a new species. The insect is altogether of a different appearance imparted to it by the greater general plumpness of the body, the larger head, the less convex but at the same time possibly still ampler thorax, the altogether more quadrated shape, etc. The remark regarding the exact number of abdominal segments left uncovered by the elytra, applies to this and all other species as well. The present one has generally the last two segments uncovered.

18. *Trichopteryx invisibilis. N.*

T. ovata, subdepressa, subparallela, pilosa, supra obscure ænea. subtus picea, pedibus, abdomine, antennis oreque testaceis. Long. corp. vex $\frac{1}{5}$ lin.

Thorax amplus, elytris sesqui minor, convexus, angulis posticis humeros vix superantibus. Elytra oblonge quadrata angulis rotundatis, subdepressa, truncata, abdomen totum vel fere totum obtegentia. Coxæ posticæ approximatæ. Tarsi typicis minus elongati, art. 3° præcedentibus haud multo longiore.

Cum *T. cursitante* victitat ; frequenter legi.

A very pretty and very distinguished species. Its most striking peculiarity consists in the posterior coxæ which are as little distant from each other as those of the anterior legs, and almost touch each other, and also in the shortness of the tarsi. The head with the antennæ, the mesosternum, the tibiæ, which are incrassated in the middle, the posterior coxæ with regard to the enlargement are quite typical. However, the thorax and elytra differ again from those of *T. cursitans*, (which in every respect may be looked upon

as the typical representative of the family in Ceylon and which is here referred to as such) the former by the shortness of the posterior angles which can hardly be said to envelope the shoulders, the elytra by being less or not at all narrowed behind, giving an oblong rather than an oval shape to the insect. Although in length only about one half shorter, it is in bulk certainly one-fourth smaller than *T. cursitans*, and, although probably the smallest Ceylon beetle, it is distinguished at first sight.

19. *Ptilium subquadratum. N.*

P. subquadratum, subconvexum, pilosum, obscure æneotestaceum, thorace dilatiore. Long. corp. $\frac{1}{4}$ lin.

Caput mediocre. Antennarum clava art. 1° inverte conico, 2° subcylindrico, ultimo elongato-ovato. Thorax convexus, angulis basalibus humeros fortissime amplectentibus, apicem versus valde rotundatus, apice leviter sinuatus. Elytra quadrata, abdomen non totum obtegentia. Scutellum parvum. Pedes robusti tibiis apicem versus incrassatis, tarsis art. 3° primi secundique longitudine, his subbilobis subtus penicillatis, coxis posticis simplicibus distantibus. Mesosternum non carinatum.

Ubi præcedentes sed infrequenter occurrit.

The g. *Ptilium* is the repository for all the anomalies of the family, its characteristics therefore are very vague, but if the absence of the mesosternal carina and the simplicity of the posterior coxæ are the determining features amongst them, the present species, in spite of a variety of anomalies exhibited in other respects, belongs to it. The head is of middling size; the antennæ robust with the 1st joint of the club of the shape of an inverted cone, the 2nd rather cylindrical, narrowed at the base and the last elongate, ovate. The thorax is of very different structure from that of the foregoing species of the family, the basal angles being unusually far produced beyond the shoulders, towards the head it is strongly and rapidly rounded off, being thus altogether of a semicircular shape, at the apex it is merely slightly sinuated, and the head is inserted rather below than in this sinuosity, the whole thorax moreover is very convex whilst the elytra are depressed. The wings vary from the

typical form by being fringed with short simple cilia instead of those long feathery appendages, they are moreover without a distinct peduncle but still folded in the manner characteristic of the family. The legs are stout with the tibiæ thickest at the tip, the 3rd tarsal joint is of the length of the preceding two, the latter are somewhat bilobed and hairy below. The posterior coxæ are simple and distant. The mesosternum without a carina. The whole shape of the insect is quadratic rather than otherwise.

20. *Ptenidium macrocephalum.* *N.*

P. ellipticum, subconvexum, nitidum, sparsim pilosum, supra piceo-æneum, subtus piceum, pedibus oreque testaceis. Long. corp. $\frac{1}{4}$ lin.

Caput maximum. Antennarum clava elongata articulis ellipticis. Thorax subquadratus antice posticeque angustatus, basi punctis 4 magnis profunde impressus. Elytra ovata, medium versus leviter inflata, apice obtuse acuminata, abdomine longiora et ampliora, punctulis lineis dispositis obsoletissime impressa. Alæ corpore plus duplo longiores. Tibiæ fortiores spinulosæ. Tarsi breviores. Prosternum carinatum.

In præcedentium societate frequenter lectum.

This is perhaps the prettiest of the five species of the family just described and at first sight recognised by the shape of its body and the polished back. The head is very large. The thorax is narrowed in front and behind, at the latter place impressed with 4 deep not to be overlooked punctures. The wing-covers are oval, a little inflated about the middle, rounded at the apex and longer and wider than the abdomen. The prosternum is carinated.

It affords me much gratification to be enabled to publish representatives of three genera of this highly interesting and probably very extensive and widely distributed family of pigmies, the Asiatic representatives of which have hitherto been entirely unknown. I have no doubt that even this Island is the abode of a great many more species.

21. *Stenus barbatus.* *N.*

S. elongatus, æneo-niger, nitidus, punctatus, sparsim pubescens, pedibus palpisque albidis, ore coxisque testaceis, antennis brunnescentibus. Long. corp. $2\frac{1}{2}$ lin.

Caput thorace tertia parte latius, fronte costis 3 abbreviatis, antice albido-pubescens. Antennæ art. 3° sequentium 2 fere longitudine, 3 ultimis elongatis, ellipticis. Palpi max. elongati apice densius pubescentes. Thorax cylindricus medio leviter incrassatus, basi subquadratus. Elytra thorace paulo longiora, sed fere duplo latiora, convexa, ovata. Abdomen immarginatum. Pedes elongati tenues, tibiis apice tarsisque fortiter setosis, his art. 4° profunde bilobo.

In lacus Colomb. ripis specimina nonnulla legi.

This as well as the following species belongs to Erichson's division II. B. of the g., both having the abdomen immarginate and the 4th tarsal joint bilobed. Everything about this species is elongated. The head is about one-third broader than the thorax, the forehead is slightly excavated with 2 elevated ridges running from the root of the antennæ a short distance upwards, a third runs from the crown of the head down towards the centre of the two former,but all three reach only to about the middle of the head. The part below the antennæ is covered with white hair. The antennæ have the 3rd joint much elongated and the terminal club composed of elliptic joints. The thorax is rather slender, incrassated at the middle, gradually narrowed in front but nearly quadratic behind. The elytra are longer than the thorax, about double its breadth and oval being slightly narrowed at the shoulders and the apex. The legs are long and slender, hairy at the apex of the tibiæ and the tarsi, the latter very much so on the inner side. The insect is of a metallic black color highly polished, the legs, palpi and the first 2 antennal joints are whitish, the tibiæ and the apex of the palpi being, however, rather darker, joints 3-11 of the antennæ are brownish, the coxæ and the mouth are yellowish, the tarsi have a brown spot at the apex of the first 3 joints, the claws are black. The insect is punctured all over, but less so on the abdomen, the apical segments of which are indeed nearly smooth, and sparingly covered with small white hairs.

22. *Stenus lacertoides. N.*

S. robustus, nigro-æneus, dense profundeque punctatus, subtus sparsissime pubescens, pedibus palpisque testaceis, femoribus apice nigrescentibus, antennis oreque castaneis. Long. corp. $1\frac{1}{2}$ lin.

Caput thorace quarta parte latius, fronte 2-costata. Antennæ robustæ art. 3° quarto paulo longiore, 9-10 globosis, 11° conico. Thorax cylindricus, medio fortius incrassatus, latitudine quarta parte longior, margine anteriore elevato, basi subquadratus. Elytra thorace longiora, convexa, humeris prominentibus. Abdomen immarginatum. Tarsi art. 4° profunde bilobo.

In prov. occid. stagnorum ripis rarius occurrit.

About this species everything is robust. It is well distinguished by the rounded club-joints of the antennæ, the elevated anterior margin of the thorax, the prominent shoulders and its general shortness and plumpness. The forehead is rather more depressed or excavated than in the former, the 2 antennal ridges are shorter, the vertical one is altogether obsolete. The palpi are robust. The 3rd antennal joint is about one-third longer than the 4th. The thorax is shorter and plumper than in the former. The elytra are less oval, having the shoulders more prominent and only the apex rounded off or narrowed. The legs are similar to those of the former, but more robust, less hairy and have the tarsi more cylindric. The insect is of a blackish metallic color, the legs and palpi are yellowish, the tibiæ, however, the apex of the palpi and also joints 1-2 of the antennæ rather darker, the femora are blackish towards the end, the mouth and joints 3-11 of the antennæ are chestnut and the coxæ pitch color. The animal is densely and deeply punctured all over, very sparingly covered with small greyish hairs, nearly obsolete on the back but more distinct below. It is less highly polished than the former. I have known this species for a long time and specimens of it must exist at the Mus. Berol.; the former I have met with but lately.

I may mention that in dissecting these two species I have observed the same remarkable production of the œsophagus with the ligula, characteristic of the g. and noticed in many of the European kinds.

23. *Anthicus quisquiliarius. N.*

A. castaneus, capite, abdomine elytrisque piceis, his pilorum niveorum fascia media transversali interrupta maculisque concoloribus 6 humeralibus obsoletis, parce pilosus. Long. corp. $1\frac{2}{3}$ lin.

Caput globosum supra subtusque profunde punctatum, oculis parvis. Thorax nodoso-pyriformis, infra medium constrictus, parte anteriore crassiore lin. long. med. profunde divisa, subcordiformi. Elytra elliptica.

Sub veget. putrescent. victitat, prope Colombo rarius legi.

This insect looks uncommonly like an ant. It is easily distinguished from all other species of the Island partly by this resemblance, partly by the sculpture of the thorax and the white fascia across the elytra. The antennæ are robust, thickened towards the tip, the three last joints forming a club. The legs have the femora very much incrassated, the tibiæ at the apex bicalcarate and the tarsi, especially of the anterior pair, very hairy below, the 4th joint appears to be slightly cordiform. The white marks of the shoulders and the fascia across the wing-covers are composed of white hairs, the former are rather an interrupted row of these than true maculæ, the fascia consists of two halves, one in either elytron, reaching neither the external margin nor the suture. The insect is of slow motion.

24. *Anthicus insulanus. N.*

A. testaceus, abdomine obscuriore, capite thoraceque rufotestaceis, elytris fasciis 2 nigris, parce pilosus. Long cŏrp. $1\frac{1}{4}$-$1\frac{1}{2}$ lin.

Caput globosum oculis mediocris. Thorax pyriformis, cum capite supra punctata. Elytra ovata. Tarsi art 4° bilobo.

Prope Negombo in pratis sat copiosus.

In some of the specimens before me the anterior femora are furnished with a strong thorn inside having at the same time the tibiæ of the same pair of legs slightly emarginated inside near the apex —I have reason to believe these individuals, if the distinction be a sexual one, to be females not males.

25. *Meligethes orientalis. N.*

M. ovatus, subconvexus, pilosus, supra nigro-æneus, subtus piceus, pedibus, antennis palpisque maxill. dilutioribus, tarsis palpisque labial. brunneo-aureis. Long. corp. 1-$1\frac{1}{2}$ lin.

Mentum transversum planum, punctatum, lobis apice depressis excavatis, glabris, obtusis Palpi lab. art. ultimo inflato, ovato;

maxill. art. ultimo apice angustato levissime truncato. Mandibulæ unidentatæ. Thorax amplus angulis acutis, antice emarginatus, postice pluries sinuatus, subtus punctatus. Elytra ovato-quadrata, angulis 4 apicalibus rotundatis, pygidium haud obtegentia. Pedes validæ. femoribus tibiisque incrassatis; anteriores tibiis apice intus unispinosis, tarsis art. 1-3 fortiter dilatatis, 1-2 subæqualibus transversis, profunde reniformibus, 3° minore, cordato, 4° minimo, subcylindrico; intermed. et post. tibiis extus spinulosis, tarsis anterioribus similibus sed art. 1-3 minus dilatatis, cordiformibus. Prosternum marginatum, punctatum, obtuse acuminatum. Mesosternum antice carinatum.

Variat magnitudine et colore æneo-brunnea.

Prope Colombo in floribus per occasionem frequentissime legi.

Of the usual shape and color, but larger than usual, varying, however, in this respect—some individuals being fully one-third smaller than others. These small individuals, which occur in the proportion of about 1 to 20, are moreover nearly always of a brownish metallic color instead of a blackish green. I have been unable to discover any other distinctions. I was much interested by the discovery of these insects, having missed them for years amongst the abundantly represented *Nitidulidæ* of the Island. They appear of local occurrence or attached to certain plants, which is nearly the same. I find them in abundance in the beautiful bell shaped blossoms of the *Argyreia argentea* and one or two other plants in my garden. The species appears to differ from the typical *Meligethes* in the following points: the structure of the mentum, which I have sufficiently described above, the last joint of the lab. palpi which in this case is not truncated, and the first of the antennæ which is externally incrassated as in *Epuræa*. The antennæ are otherwise robust, the club is firm and hairy. The thorax is very ample, thinly ciliated along the upper part of the anterior margin, rather strongly below. The prosternum is largely developed, marginated, punctured and obtusely acuminated, overlapping the anterior part of the mesosternum which (the anterior part) is cylindric and carinated. Joints 1-3 of the tarsi are strongly penicillated below, the penicilla being composed of glanduliferous hairs of a fine golden color.

26. *Georyssus gemma. N.*

G. pygmæi statura et magnitudine, supra purpureo æneus, iridescens, subtus piceus; *alatus.* Thorax subsemiorbicularis infra apicem constrictus, sulco med. long. divisus, lateribus, basi apiceque excavatus, impressionibus 3 majoribus dorsalibus, 2 minoribus lateralibus. Elytra fortissime costata, costis obtuse dentatis, in interstitiis transversim punctato-impressa, ad humeros profunde excavata, infra medium leviter sinuata. Tibiæ extus spinulosæ, intus sparsim ciliatæ.

In prov. central. montibus Kotmaliensibus alt. 3,500 ped. in rivulorum ripis non infrequenter legi.

Lacordaire and others characterize the g. *Georyssus* as having the elytra soldered together and being destitute of wings. *In the present species, however, the elytra are unconnected and cover wings proportionately larger than in any other beetle, I can at present think of.* They are elongated and comparatively narrow, resembling in shape very much those of a *Libellula,* have a few veins at the base and are ciliated at the margin. I have moreover occasionally taken insects of this g. *flying* about the light at night, but I am not quite sure at present whether it was this species or another. The sculpture of the thorax is complicated and difficult to describe, however, the leading features in it are these: a subapical sinuosity on either side; a longitudinal furrow; excavated sides, base and apex; 3 larger dorsal depressions (1 central, 2 obliquely basal) and 2 smaller lateral ones at the subapical sinuosities—a short elevated ridge at the centre of the base separating the two basal impressions and being itself divided by the longitudinal furrow; two elevations separating the anterior part of the basal impressions from that of the central one (at the middle these three depressions are connected); two small rugosities near the anterior margin, one on either side of the longitudinal furrow.

The sculpture of the elytra is less complicated: they have a deep cavity at the shoulder, a large, but not deep, sinuosity below the middle and are obtusely acuminated. The costæ of the back are 11 in number, the suture lying in the central one. The half of this central costa and the exterior margin form an elevated border

round either elytron. The first and second on either side run towards the apex but come to a stop (very abrupt in most, but less so in some specimens) before reaching it, the third after having been interrupted near its base by the subhumeral cavity runs on but does not reach as far as the former, the 4th does not leave the region of the shoulder, the last on either side is very prominent at the base but soon forms an abrupt declivity and runs on as a low ridge to below the middle. The back of all these costæ is obtusely dentated. The interstices are marked with large, shallow, transverse impressions. The head of the insect is rather large and even. The mandibles are furnished with an obtuse subapical tooth, the two lower thirds are ciliated. The maxillæ have the apex of the outer lobe externally enlarged, rounded off and furnished with three strong teeth replaced by cilia on the inside, the inner lobe is conic and similarly provided with teeth and cilia, however, much thinner and finer. The maxill. palpi are robust, the last joint is inflated at the base. The antennal club is hairy, dark (whilst the remaining joints are yellowish), conic and somewhat securiform, the 6th joint being inserted on one side of the 7th. The legs are robust, the tibiæ slightly curved, obliquely truncated at the end, furnished with spines along the outside and with distant cilia along the inner.

27. *Hydrochus lacustris. N.*

H. elongatus, subdepressus, supra metallicus, iridescens, subtus piceus, pedibus, antennis, palpis elytrorumque margine magis minusve brunneis, mento cyaneo. Long. corp. m. 1 lin., f. multo major atque robustior.

Palpi maxill. robusti, art. ultimo elliptico leviter inflato. Mandibulæ apice bifidæ. Antennarum clava dense pilosa. Thorax oblonge quadratus basin versus angustatus basi medio productus, cum capite profunde punctata. Elytra ad humeros oblique truncata, apicem versus sat fortiter angustata, profunde striatopunctata. Tibiæ extus spinulosæ.

Specimina nonnulla in lacu Colomb. legi.

The head is robust, broader than the thorax, the eyes large and prominent.

The femora, the last joint of the maxill. palpi, the mandibles and the tarsal joints are dark towards the apex. The last abdominal segment of the f. is furnished with a bifid hairy appendage.

28. *Hydrous rufiventris. N.*

H. ovatus, convexus, supra oleagino-niger, subtus obscure ferrugineus, pedibus dilute piceis, labro æneo, reliquis oris partibus cum clypeo testaceis. Long. corp. g. lin.

Palpi maxill. articulis apicem, versus abruptius incrassatis, art. 3° quarto sesqui longiore. Antennæ art. 7-8 fortiter perfoliatis, ultimo acuminato. Caput antice utrinque punctulorum serie subsemicirculari et ad oculorum marginem interiorem impressum. Thorax punctulorum seriebus 4 lateralibus, 2 subapicalibus obliquis abbreviatis signatus. Elytra subtiliter striato punctata. Tarsi omnes unguibus basi fortiter unidentatis. Carina prosternalis cultriformis.

Specimen singulum f. nocte ad lumen cepi.

As far as my resources allow me to ascertain a very anomalous species having the perfoliated antennæ and toothed claws of a *Hydrophilus* and the cultriform prosternal carina and the elytra of a *Hydrous.* I have placed it in the latter g. on account of the sharp edge of the prosternal carina, in which the great distinguishing character of this g. seems to lie, the same being deeply grooved in *Hydrophilus.*

The insect at once attracts attention by the reddish color of its abdomen. It is of a blackish olive color on the back, having however the clypeus and the anterior margin of the labrum of a yellowish brown, the latter being otherwise of a somewhat metallic color. The remaining parts of the mouth are more or less yellowish. Joints 1-6 of the antennæ are yellowish too, with the exception of the 2nd which is dark, joints 7-9 are blackish and pubescent. The legs are of a light pitch color. The lower part of the head is impressed with two rather semicircular series of punctures, similar punctures occurring along the internal margin of the eyes. The thorax is marked with six series of them and on the elytra they are arranged in lines. The sternal carina is well developed, the

prosternal part has a sharp edge, whilst the mesosternal one is obtuse on the back and the metasternal part depressed and slightly grooved.

29. *Hydrous inconspicuus. N.*

H. præcedente minus convexus, supra oleagino-niger, subtus rufo-piceus, ore testaceo. Long. corp. 4½ lin.

Palpi maxill. art. 2° et 4° subcylindricis, 3° apicem versus sensim incrassato, sequente tertia parte longiore. Antennæ art. 7-8 sub-globosis, 9° magno, ovato. Caput, thorax et elytra ut in præcedente sculpta et signata.

In lacu Colomb. mens. Jun. non infrequenter cepi.

This is in every respect a normal species. The prosternal carina has a sharp edge, the claws are simple, the antennal club is composed of rounded joints, the elytra are of the typical structure etc. In the latter respect as well as with regard to the various series of punctures upon head, thorax and elytra, it resembles the former, the punctures of the elytra are, however, less distinct. Joints 1-6 of the antennæ are yellowish, the club being dark and finely pubescent. The maxill. palpi have joints 2 and 4 subcylindric but the intermediate one thickened towards the tip.

In the month of June, I have not unfrequently taken the pupæ of this species on the banks of the Colombo lake and hatched them at home. I found them about one inch under ground and often as far as 12 feet from the edge of the water but still in muddy places. The imago is very active, perhaps more so than any other species of the g.

No. III.

GENERAL REMARKS ON THE SCYDMÆNI DESCRIBED BELOW.

In the first number of these papers I have described a winged species of *Œdichirus*, a g. supposed to be without organs of flight; in the second number I have given publicity to the more important discovery of wings in the single g. which forms the family of the *Georyssi*, also hitherto supposed to be apterous ; at present I am about to announce to some and to confirm to others, the existence

of these organs in the family of the SCYDMÆNIDÆ, a fact, although incomplete, of more importance than either of the former considering the extent of the family and the difference of opinion which appears to exist on the subject amongst the most eminent entomological authorities. It is this importance which induces me to enter more fully on the subject.

I am not acquainted with the famous monograph of the family of the SCYDMÆNIDÆ by Dr. Schaum; however, from the manner in which it is quoted by Lacordaire in his g. d. Col.—I should infer that these two celebrated authors agree in all the vital points. In Lacordaire's diagnosis of the family these insects are described as having (with the exception of the American g. *Brathinus*, of which Lacordaire is not quite sure that it belongs to the family) the elytra soldered together and being destitute of wings. Now, although it is scarcely credible that on a point so easily ascertained as this, any difference of opinion should exist, still Westwood in his Modern Classification of Insects, in describing the same family makes statements which imply the contrary. However, Lacordaire's description being fifteen years earlier, in fact the most recent book on the subject, is from this reason alone entitled to be considered before all others, and looking upon it in this light, that is as the essence of all former observations, I shall for the present occupy myself with it alone. According to this description, as mentioned above, the insects referred to, *have the elytra soldered together and are destitute of wings.* This being the case, I was startled to find that out of the 13 species described below, 9 or 10 which I examined in this respect, had neither the elytra soldered nor were they destitute of wings—*on the contrary the elytra were unconnected in the middle and the wings were nearly double the size of the whole insect and could not possibly be overlooked.* I would willingly suppose that the 100 species of this family contained in European collections, and principally derived from Europe and N. America, agreed with Lacordaire's description and that the Ceylon species formed exceptions to the general rule, were it not that Westwood's observation alluded to above corroborates my own and renders me suspicious that some unaccountable mistake or oversight may have occurred. That this mistake cannot consist in

a slip of the pen or a misprint in the g. des Coléoptères quoted above, is clear from the obvious care which has been bestowed upon every part of that work, and from the same remarks being repeated in different words. To attempt to discover how this mistake occurred, and upon what grounds it rests—would under my circumstances be useless. However, it appears certain to me that some more detailed and positive remarks on the subject cannot be superfluous, and must be new to some Entomologists. Placing the fullest confidence, as every one naturally would do in the infallibility of the description of the Belgian author, it was not likely that I should have looked for wings at all in the SCYDMÆNIDÆ (a family to which I have not until lately paid much attention) had I not been struck by seeing the elytra of my *S. alatus* open, when handling it with a fine paint brush in a drop of water, it being at the time quite out of the question that the opening could have been effected by pressure. On opening the elytra fully I had no difficulty in discovering the wings. Rendered extremely curious by this discovery—diametrically opposed as it was to the distinct statement of so great an authority, I now examined other species, and all with the same result, most of them opening the elytra without my assistance in the same manner as the *S. alatus*, and I have not the slightest doubt that when a sufficient number of specimens shall enable me to examine the rest it will still be with the same result. That these insects use their organs of flight may be gathered from the following fact: At a former period I lived in a house situated on a small eminence and overlooking extensive groves of Cocoanut trees, Cinnamon gardens, Paddy fields and patches of jungle. Here I collected large numbers of PSELAPHIDÆ, especially *Euplectus*, in thin, scarcely visible spider webs with which the white walls of the house were covered in certain places—thus forming one large trap for anything small flying about. That these had been caught when on the wing there could be no doubt, but I was much surprised to find with them (what is so common in more congenial localities, here also) a considerable number of SCYDMÆNI, especially my *S. advolans* and *pubescens*, a family pronounced by the most recent authority to be unable to fly, in a position which they could not well have found

themselves otherwise but by flying. From some reason or other, I am ashamed to say, I did not follow up the matter at the time, but I am now certain on the subject. Indeed to remove all doubt and to settle all disputes I have just been so fortunate as to take my *S. advolans* actually on the wing flying in my garden in the evening at sunset.

Having gone so far, I will (in spite of some slight misgivings of being laughed at for telling an old story with so grave a face) add a few descriptive words about the organs in question: The wings of my SCYDMÆNI are ample, about double the size of the whole insect, oblong, having the margin beautifully ciliated and, with the exception of a few yellowish veins at the base, without any visible organs of this kind.

In spite of the difference in their shape etc. I believe the species described below to be all genuine SCYDMÆNI as restricted at present. Being, however, unacquainted with the sexual distinctions of these insects (which indeed I believe not to have been satisfactorily pointed out by any one, and to differ in different species) I should not be surprised if one or two of my species were eventually ascertained to have been separated upon these grounds alone. However, having been very reluctant to admit new species, it is just as likely that individuals may hereafter be found united in one which ought to be separated into two species. But I trust that neither contingency may happen. The species were all collected by myself in the immediate neighbourhood of Colombo. I have, however, no doubt that they occur all over the S. W. part of the Island, which is of an uniform physical character, and they may perhaps occupy a still larger portion of it. None of them are very common, on the contrary, of nearly half of them I possess only one or two specimens. My *S. femoralis* I found under the soft, rotting bark of an Erythrina indica. *S. Ceylanicus* and *ovatus* I found dead in spiderwebs. *S. graminicola*, *glanduliferus* and *pyriformis* I have hitherto taken exclusively in the sweeping net on the lawn of my garden about sunset, the other species I have met with indiscriminately in spiderwebs, under rotting vegetable substances and in the grass.

After this preamble, which I trust may not be deemed quite superfluous, I now enter upon the description of my species, previ-

ously drawing attention to the three very natural and very distinct groups which they form and the characteristics of which will at once be perceptible from the headings given below. With regard to the first group (A. I. spec. 30-34) I may mention that the elongated legs, largely developed posterior trochanters and often distant posterior coxæ give the insects belonging to it a staggering motion when walking, which together with their oblong, subdepressed body distinguishes them at a glance. I have subdivided them from the cultriform or grooved mesosternal carina. The second group (A. II. spec. 35-41) is equally well characterized as the former by the more robust, pyriform and subconvex body of the insects. *S. pselaphoides* in the former and *S. advolans* in the present group, form connecting links between the two, especially *S. pselaphoides* which in general appearance rather belongs to the second, upon closer examination however is easily ascertained to be an anomalous member of the former. I have divided the second group into two subdivisions distinguished by the rounded or narrowed occiput giving preference to the distinctions to be drawn from this part of the body rather than to those derived from the thorax, which from the variety of shapes it assumes would naturally suggest itself for that purpose, but the gradations between the principal forms appear to me too many, too fine and therefore too indistinct to adopt them. As to the third group (B. spec. 42) the insect which alone forms it amongst those described below, is so different from any of the others that its peculiarities must strike any one at first sight.

A. Species with a thick neck, abruptly formed and immersed in the thorax.

I. Fourth joint of the maxill. palpi not acuminated; head subquadrato—ovate; eyes middling or small, finely granulated, little or not at all prominent; antennæ subapproximate at the base; posterior trochanters elongated, incrassated at the apex; thorax obovate; body elongate, subdepressed.

(a.) Mesosternal carina slight, simple.

30. *Scydmænus. alatus. N.*

S. dilute brunneus, pedibus antennisque dilutioribus, tarsis palpisque testaceis; pubescens; long. corp. $\frac{2}{3}$ lin.

Antennæ art. 1° apice biacuminato, 3-4 subæqualibus, 5 præcedente majore, 6 longitudine inter 4 et 5, ovato, 7-8 subæqualibus, 9 majore, 7-9 *apice angustatis, tubiformibus,* 10-11 ovatis, clavam formantibus, *vel* art. 9 globoso, 9-11 clavam formantibus. Palpi maxill. art. ultimo minimo apice truncato. Mandibulæ dente bifido munitæ basi fortiter abrupteque dilatatæ. Thorax foveis basalibus nullis. Pedes elongati tarsis art 2-3 subæqualibus,

I include in this species individuals with a two and others with a three-jointed antennal club. The latter are further distinguished by having a slight sinuosity in the rounded outline of the basal angles of the thorax, by having the posterior part of the metathorax and the base of the abdomen sensibly incrassated, and the head rather less quadrate than the former. However, the individuals thus distinguished being in all other respects exactly like those with the two-jointed club, I cannot help looking upon all these distinctions as sexual ones and uniting the insects in the same species.

The head from the eyes to the neck is of a transverse subquadrated form merging into oval by the angles being rounded off, the anterior part is narrowed. And this is the typical sculpture of the scull in all the five species of this group. The eyes in the present species are middling. The antennæ are rather approximated at the base and inserted in the centre of the front under a ridge which runs across it from eye to eye. The first joint is biacuminated at the apex, the 5th is longer than the adjoining ones, joints 7-9 in the individuals with the two-jointed and 7-8 in those with the three-jointed club are of a peculiar construction being narrowed at the apex and fitting into each other like the tubes of a spyglass. The club joints are ovate, flat at the base, the last is large and obtusely acuminated. I consider the principal distinguishing character to lie in the remarkable structure of joints 7-9 of the antennæ. The maxill. palpi have joint 2 rather strongly incrassated at the apex, joint 3 obovate, narrowed at the base, joint 4 very minute, truncated at the apex. The mandibles are furnished with a bifid tooth and are strongly and abruptly dilated at the base. The thorax is of an obovate or obcordato—ovate form being rather strongly rounded off before the middle and gradually narrowed below it; the usual basal impressions are wanting, the pos-

terior margin has 2 slight sinuosities, the posterior angles are rounded off or obliquely truncated. Scutellum obsolete. Elytra furnished with a very short elevated ridge at the shoulder. Legs elongated; coxæ large, the 2 posterior ones rather distant from each other; 2 posterior trochanters much elongated, incrassated at the tip; apex of tibiæ subcylindric, but not narrowed, and hairy, especially in the 2nd pair; joints 2-3 of the tarsi of equal size, the first longer, the 4th a little shorter, the two anterior tarsi slightly contracted, 2nd and 3rd pair more and more elongated. Penultimate segment of abdomen with a strong longitudinal groove on the back.

31. *Scydmænus femoralis. N.*

S. statura et magnitudine præcedentis; testaceus. Antennæ art. 3-4 subæqualibus, 5 præcedente longiore, 6-8 gradatim minoribus, subglobosis, 7-8 apice fortius oblique truncatis, 9-11 gradatim majoribus, subglobosis, clavam formantibus. Palpi maxill. art. ultimo minimo semigloboso. Thorax magnus obovatus, basi rotundatus, 4 foveolatus. Elytra *apice truncata, 2-sinuata.* Pedes *femoribus 2 posticis medio constrictis,* tarsis art. 1-4 gradatim minoribus.

Of the general appearance of the former but of a light yellowish color and well distinguished by the large thorax, truncated elytra and abnormal construction of the 2 posterior femora. Antennæ with joints 7-8 rather strongly obliquely truncated at the apex, 9-11 forming a club, subglobose, flat at the base, the last acuminated and slightly cut away or even excavated on the inside at the apex. Last joint of maxill. palpi semiglobose, these otherwise the same as in the former. Thorax and elytra of S. *alatus,* the former however, larger, rounded at the posterior margin and with 4 basal impressions the latter slightly truncated at the apex and with a slight sinuosity in the truncature on either side of the suture. Scutellum very small. Legs with the tibiæ slightly bent at the base, the apex as in the former: tarsi with joints 1-4 gradually decreasing in size, first pair contracted and furnished with brushes on the inside. The 2 posterior legs inserted rather distant from each other, the basal part of abnormal construction: the trochanters are much elongated and incrassated at the tip whilst the femora are at the place of the juncture rather abruptly narrowed, bent and slightly compressed, they

being at the same time thinner than the adjoining apex of the trochanter the constriction is very striking.

32. *Scydmænus Ceylanicus. N.*

S. alati colore, sed major et magis depressus; long. corp. $\frac{3}{4}$ lin. Caput magnum, robustum, thoracis latitudine. Antennæ basi non approximatæ, art. 3-4 et 5-7 inter se subæqualibus, *arcum formantibus*, 8-10 gradatim majoribus, subglobosis, depressis, apice oblique truncatis, 11° magno, conico, 8-11 longius pilosis, clavam formantibus. Palpi maxill. art. 4° minimo, semigloboso. Thorax ovatus, foveis basalibus nullis. Elytra apice singulatim rotundata. Pedes validi tarsis art. 1-4 subæqualibus, 2 anterioribus art 1° *subtus acumine sat forte producto.*

An anomalous species, especially with regard to the antennæ which are much less approximated at the base than those of the rest of the species belonging to this group, and with regard to the 2 posterior coxæ which on the contrary are more approximated than in any of the species just referred to. The insect is of the light brown color of the two former but larger and more depressed. The head is strikingly large and heavy, of the width of the thorax, in its hind part, which is strongly transverse, the oval form prevails over the square. Eyes small. Antennæ inserted under two strong protuberances rather than under a ridge, their club 4-jointed, joints 3-7 forming an inwards bent section of a circle, joints 8-10 strongly compressed, obliquely truncated (subperfoliated) 11 large, conic. The 3rd joint of the maxill. palpi is of an oblongo-ovate shape, the external basal angle is prolonged into a small peduncle inserted in the apex of the 2nd joint, the 4th joint about the semiglobose shape of which I am not quite satisfied appears to be obliquely inserted in the tip of the preceding. Thorax oval, of a similar shape to that of the former, anterior margin slightly emarginated. Scutellum obsolete. Elytra with the traces of a humeral costa, separately rounded off at the apex. Legs strong, 2 posterior coxæ not more distant from each other than the 4 anterior ones; tibiæ elongated, bent at the base and apex, at the latter place slightly narrowed, subcylindric and hairy; tarsi with joints 1-4 subequal, in the first pair strongly contracted, joint 1 of this pair produced in a spine on the inside.

(b.) Mesosternal carina middling, grooved.

33. *Scydmænus intermedius. N.*

S. alati statura sed major et robustior, colore obscuriore ; long. corp. $\frac{3}{4}$ lin.

Antennæ art. 1° apice biacuminato, 2 et 5, 3 et 4, 7 et 8 inter se subæqualibus, 6 quarto paulo minore, obovato, 7-8 subglobosis apice oblique truncatis, 9-11 gradatim majoribus, obovatis, clavam formantibus, 11 acuminato. Palpi maxill. art. 3° obovato, 4° minimo semigloboso. Thorax subrotundatus, basi 4-foveolatus. Elytra apice singulatim rotundata. Pedes tarsis art. 1-4 gradatim minoribus vel 2-3 subæqualibus, 4 anterioribus intus pilosis. Mesosternum sat fortiter carinatum, *carina dorso deplanata, fossulata apice acuminata.*

This species stands in the middle between *S. alatus* and *pselaphoides.* To the former it is allied by its general appearance rather than by anything else, differing from it very much in the structure of the antennæ and the mesosternal carina. To the latter on the contrary it is allied by similarity in the structure of the said carina, differing, however, from it in general appearance. The color is that of *S. alatus* but a shade or two darker, the insect, being at the same time larger and altogether more robust. The eyes are small. Antennal club 3-jointed, the joints forming it gradually increasing in size, obovate,flat at the base, the last acuminated. Scutellum obsolete. Elytra with 2 slight basal impressions, the traces of a humeral costa, separately rounded off at the apex. Legs elongated as usual ; 2 posterior coxæ distant, tibiæ straight, subcylindric but not narrowed at the apex, the 4 anterior ones hairy ; tarsi with joints 1-4 almost imperceptibly decreasing in size or perhaps 2-3 equal, the anterior ones slightly contracted, these and the intermediate ones hairy on the inside. Mesosternal carina middling, flat on the back with a shallow, but very distinct, longitudinal groove or excavation, anterior part projecting, acuminated.

34. *Scydmænus pselaphoides. N.*

S. subpyriformi—ovatus, subconvexus, magis minusve brunneus, pedibus antennisque subtestaceis, femoribus apice nigrescentibus, tarsis palpisque testaceis ; flavo-pubescens long. corp. 1-1$\frac{1}{4}$ lin.

Antennæ art. 1° mediocri, apice biacuminato, 2-4 sensim minoribus, 5 et 2, 6 et 3, 7 et 8, 9 et 10 inter se subæqualibus, 9-11 clavam formantibus, 6-11 basi rotunde truncatis, 6-8 apice oblisque truncatis, 7-8 compressis, 9-11 obovatis. Mandibulæ dente bifido munitæ, basi dilatatæ et ciliatæ. Palpi maxill. art. 3° inverte conico, 4° minimo apice truncato. Thorax obovatus, latitudine quarta parte longior, basi 4 foveolatus. Elytra apice singulatim rotundata. Pedes validi, tarsis art. 1-4 gradatim minoribus, anterioribus dilatatis, his cum intermediis subtus fortius pilosis. Mesosternum præcedentis.

An anomalous species with regard to its general appearance which differs considerably from that of the rest of the group, and makes it, as I remarked above, the connecting link between this and the following group. This is the largest species I have hitherto met with. The system of coloration is the usual one: more or less deep brown, legs and antennæ lighter, tarsi and palpi quite so. Eyes middling. Antennæ with a 3-jointed club, the joints subglobose, flat on the base, the last large, conic, joints 6-8 are slightly truncated at the apex, 7 and 8 being at the same time strongly compressed have a subperfoliated appearance. The mandibles are furnished with a bifid tooth. The 3rd joint of the maxill. palpi is of the shape of an inverted cone, the 4th minute and truncated at the apex. The thorax is of an obovate form, about one-fourth longer than broad, rounded off before and gradually narrowed below the middle, subquadrate at the base impressed with 4 foveæ or pits, the posterior angles rounded off. Scutellum minute. Elytra with 2 short humeral costæ, separately rounded off at the apex. Legs stout; 2 posterior coxæ distant; tibiæ slightly bent at the base, subcylindric at the apex, the 4 anterior ones hairy; tarsi with joints 1-4 gradually decreasing in size, the anterior ones dilated, the joints transversely triangular, the intermediate pair hairy on the inside. Mesosternum of the preceding. Metasternum with a slight longitudinal depression down the middle. Penultimate abdominal segment grooved on the back as in S. alatus. The enlargement of the anterior tarsi (as in other beetles) indicates undoubtedly a sexual distinction, since it is not equally

strong in all individuals. I may mention here that upon some of the individuals I found ticks (some g. allied to *Ixodes* but not a *Gamasus*) fastened, one of them having made a wound such as, supposing it to be inflicted at a corresponding place and on a proportionate scale, few animals of a higher order, I think, would have survived—still this little beetle appeared perfectly at its ease. The parasite alluded to had fastened itself right in the centre of the forehead and the wound it had inflicted in this, one should imagine most dangerous place, was a deep hole or pit with a callous border. The latter led me to infer that the injury was an old one, and the tick being at the time fastened in it (and this so firmly that I had some difficulty in detaching it) I felt sure it had been in this position for months. The injury was observable under a slight magnifier and I think to compare it to one inflicted by a rifle-ball would be greatly underrating its importance.

II. Fourth joint of the maxill. palpi acuminated; mesosternal carina strongly developed; eyes large, prominent, coarsely granulated; antennæ distant at the base; 2 *posterior trochanters simple; thorax variable; body robust, pyriform; subconvex.*

(a) Occiput rounded.

35. *Scydmænus advolans. N.*

S. long. corp. $\frac{3}{4}$ lin. Antennæ art. 3 et 4, 5 et 6 inter se subæqualibus, obovatis, 7 majore, subgloboso, 8-10 subglobosis, basi rotunde—, apice oblique truncatis, cum 11° conico clavam formantibus. Palpi maxill. art 3° elongato, inverte conico, 4° mediocri. Mandibulæ tenues, medio acuminate 1-dentatæ, basi abrupte dilatatæ. Thorax ovato-rotundatus, apice fortius angustatus, basi leviter 2-sinuatus, 4-foveolatus. Elytra apice singulatim rotundata. Tarsi art. 2-3 subæqualibus.

The insect is of brown color, the antennæ lighter, the legs still more and the tarsi and palpi quite so, the femora are dark towards the apex, the head, thorax and suture are occasionally of chestnut color; it is as usual pubescent. The sculpture of the head in this and the following species is not, as in the preceding, based upon the oblong square or the oval, but rather upon the form of a ball

which in a more or less compressed state is always perceptible ; in some instances it is narrowed on one side. In the present species the head is heavy and subglobose. The eyes are large, prominent and coarsely granulated. The antennæ are inserted distant from each other under two protuberances of the anterior part of the forehead. The club is 4-jointed, the joints composing it, being flat at the base, and, with the exception of the last, obliquely cut away at the apex, the last itself being conic. The maxill. palpi have joint 3 rather elongated and of the form of an inverted cone, joint 4 middling, acuminated. The thorax is of a rounded oval shape and rather strongly narrowed towards the apex. The scutellum is obsclete. The elytra have the usual rudimentary costæ at the shoulders and are separately rounded off at the apex. The legs are middling, 2 posterior coxæ inserted close together, trochanters all simple, tibiæ slightly bent at the base, narrowed and subcylindric at the tip, the 4 anterior ones hairy, tarsi with joints 2-3 subequal, the first a little longer and the 4th shorter, the 2 anterior ones slightly contracted. I include in this species some individuals which slightly differ from the foregoing description, being more robust, covered more densely and with longer hair, especially on the occiput and thorax, with the latter rather obconico-ovate and the costæ of the elytra more distinct, and moreover occasionally of a chestnut color.

36. *Scydmænus pubescens. N.*

S. præcedente gracilior; long. corp. $\frac{2}{3}$ lin. Antennæ art. 3 et 4, 5 et 6 inter se subæqualibus, subcylindricis, 7° secundo paulo minore, *fortiter cylindrico,* 8-10 subglobosis, cum 11° conico clavam formantibus. Palpi maxill. art. 3° inverte conico, 4° minuto. Mandibulæ tenues, medio obtuse obsoleteque unidentatæ, basi abrupte dilatatæ. Thorax conicus, latitudine haud longior, basi 4-foveolatus. Elytra et pedes præcedentis, tibiis tamen apice leviter arcuatis.

Less robust than the former and further distinguished from it by the 7th antennal joint (the one preceding the club) which is of a strongly cylindric shape, by the minuteness of the last joint of the maxillary palpi, the obtuse and nearly obsolete tooth of the man-

dibles, the short-conical form of the thorax and the tibiæ which are slightly bent at the apex.

37. *Scydmænus pygmæus. N.*

S. statura et colore præcedentis sed longius pubescens et sesqui minor; long. corp. $\frac{1}{3}$ lin. Antennæ art. 3 et 4, 5 et 6 inter se subæqualibus, 7° majore, ovato, 8-10 subglobosis, fortius compressis, cum 11° clavam formantibus, hoc magno, obconico, apice obtuso. Palpi maxill. art. 2° tenuiore, 3° inverte conico, 4° minuto. Mandibulæ obsolete unidentatæ. Thorax conicus latitudine parum longior, elytris fortiter applicatus, basi 2-sinuatus et 4-foveolatus. Pedes et elytra præcedentis, his tamen amplioribus.

Strongly allied to the two preceding species, still very much smaller, more compact and covered with longer hair—thus of rather a different appearance regardless of its size. From *S. pubescens* this species would principally differ in the shape of the 7th antennal joint, also in that of the three first club joints which are much more compressed and more hairy in *S. pygmæus.* The thorax of the latter is more firmly applied to the base of the elytra, the latter have a fuller, more robust appearance about them, the palpi are more slender and the tooth of the mandibles is pointed. From *S. advolans* it would principally differ, besides in the generalities mentioned above, in the shape of the thorax and in some of the points in which it differs from *S. pubescens.*

(*b*) *Occiput narrowed.*

38. *Scydmænus glanduliferus. N.*

S. robustus; long. corp. $\frac{3}{4}$ lin. Antennæ art. 3-7 sensim majoribus, 8-10 globosis, fortiter compressis, cum 11° *glanduliformi* clavam formantibus, longe ciliatis. Palpi maxill. art. 2° tenuiore, 3° inverte conico, 4° mediocri. Thorax conicus latitudine basali haud longior, elytris fortiter applicatus, basi 2-impressus, in impressionibus 2-foveolatus. Tarsi art. 2-3 subæqualibus.

Of the size of *S. advolans* and the plump shape and color of *S. pygmæus* the latter being rather lighter than that of *S. advolans;* it has the longer (especially on the occiput and thorax) hairy vesture of the former. The occiput is slightly narrowed behind. The

antennal club is composed of 4 joints, the 3 first of which are strongly compressed, the 4th being plump and of the shape of an acorn with its cup, all are strongly ciliated. The thorax is conic, firmly applied to the base of the elytra as in the preceding species, depressed and with 2 pits at the base, posterior margin with 2 sinuosities. The shoulder-ridges of the elytra are short but rather strongly marked. The tibiæ are narrowed, subcylindric and hairy at the apex. Joints 2-3 of the tarsi are subequal, the anterior pair more, the intermediate less contracted.

39. *Scydmænus graminicola. N.*

S. gracilior; long. corp $\frac{3}{4}$ lin. Antennæ art. 3 et 4, 6 et 7, 9 et 10 inter se subæqualibus 5° adjacentibus paulo longiore, 3-7 subcylindricis, 8 subgloboso, 9-10 fortiter globosis cum 11° clavam formantibus. Palpi maxill. art. 3° inverte conico, 4° mediocri. Mandibulæ apice arcuatæ, medio acuminate 1-dentatæ, basin versus *sensim dilatatæ*. Thorax obconicus basi depressus, 2-sinuatus et 2 foveolatus, rectangulatus. Pedes *tibiis elongatis* basi apiceque arcuatis.

Of the usual brown color, legs and antennæ lighter, tarsi and palpi quite so, femora nigrescent at the apex, hairs of occiput and thorax rather long. The former slightly narrowed behind, the head thus of a somewhat rhomboid form. Antennal club composed of 3 joints, the 2 first of which are strongly globose, the last being acuminated and slightly cut away on one side at the apex. The mandibles are furnished with an acuminated tooth at the middle, bent at the apex and, what is rather uncommon in this g., gradually enlarged towards the base. The thorax is obconic, rather longer than broad. The elytra are somewhat more stretched than usual in this group, the rudimentary humeral costa are rather prominent and they are separately rounded off at the apex. Tibiæ more or less elongated, slightly bent at the base and apex, at the latter place subcylindric and hairy. Tarsi with joints 2-3 subequal, first pair slightly contracted. A sexual distinction appears to be expressed in the length of the tibiæ which are less elongated in certain individuals which are at the same time less

robust than the others. The insect is easily distinguished by its general appearance.

40. *Scydmænus pyriformis.* *N.*

S. supracastaneus, subtus brunneo-testaceus, pedibus antennisque dilutioribus, tarsis palpisque flavo-testaceis, antennarum clava nigricante ; long. corp. $\frac{1}{2}$ lin.

Antennæ art. 3-8 fere subæqualibus excepto 5° parum longiore, 8° subgloboso, minore, 9-10 subglobosis majoribus, cum 11° acuminato clavam formantibus. Palpi. maxill. art. 3° inverte conico, 4° minuto. Thorax obovatus, basi 2-foveolatus. Pedes coxis 2 posticis distantioribus ; tibiis 2 anterioribus basi apiceque leviter arcuatis, reliquis subsimplicibus ; tarsis art. 2-3 subæqualibus.

A pretty little species, at once distinguished by its color which is chestnut, darker at the base and suture of the elytra, and light, more or less brownish or yellowish, below, the antennæ being of the latter color with a nigrescent club. The occiput is slightly narrowed, the head altogether plump, heavy and transverse. The antennal club is composed of 3 subglobose joints the last of which is acuminated and slightly cut away on one side as in some of the preceding species. The thorax is obovate, broadest below the middle and gradually narrowed towards the apex. The elytra have the usual two shoulder-ridges and are rather strongly dehiscent at the apex. The posterior coxæ are rather distant at the base ; the tibiæ are slightly angustated and subcylindric at the apex, the 4 anterior ones hairy, the first pair moreover slightly bent at the base and apex, but the rest nearly straight.

41. *Scydmænus angusticeps.* *N.*

S. castaneus, antennis pedibusque dilutioribus, tarsis palpisque testaceis ; long. corp. 1 lin.

Caput magnum subtrigonum, occipite *fortiter angustato,* hoc cum thorace longe pilosis. Antennæ art. 3 et 4, 5 et 6 inter se subæqualibus, 7-11 gradatim majoribus, vel 9-10 subæqualibus, subglobosis, 8-10 leviter depressis, cum 11° clavam formantibus. Palpi maxill. art. 2° tenuiore, 3° inverte conico, 4° mediocri, conico-acuminato. Thorax obconicus basi subquadratus, 2-sinuatus et 4-foveolatus. Elytra costis 2 fortioribus abbreviatis. Tibiæ subrectæ.

A handsome species of more or less deep chestnut color with lighter legs and antennæ. The head is large, heavy and from the eyes to the neck strongly triangular, the occiput and thorax are covered with long hair, which adds much to the peculiar appearance of the insect. The antennæ are thick and robust, the club 4-jointed. The thorax is subquadrate at the base up to the middle and conic towards the apex. The punctures or pits at the base are four in number. The scutellum is small. The humeral costæ are stronger developed than in any of the other species and traceable to the middle of the elytra. The tibiæ are nearly straight, subcylindric at the apex, the 4 anterior ones hairy. The tarsi have joints 2-4 nearly subequal.

B. Species without a neck.

42. *Scydmænus ovatus N.*

S. ovatus, convexus, brunneus ; long. corp. $\frac{1}{2}$ lin.

Caput subquadrato-ovatum. Antennæ art. 3-11 sensim incrassatis, 9-11 subglobosis, depressis, cum 11° magno, conico clavam formantibus. Palpi maxill. art. 4° minuto acuminato. Thorax *amplus semiorbicularis*, margine posteriore medio producto, basi 2 foveolatus. Tarsis art 1-4 subæqualibus.

The color of this insect is as usual shaded off from brown to light yellow ; however, in other respects it differs materially from all the preceding species. The body is regularly oval, thorax and elytra convex, pubescent. The head is subquadrato-ovate ; the eyes rather small, but prominent ; the neck is altogether wanting. The antennæ are at the base as distant from each other as they can be being inserted below the eyes ; the club is 3-jointed ; the joints increase gradually in size from the 3rd to the 11th. The maxill. palpi have the 2nd joint slender, the 3rd rather pearshaped, the 4th minute and acuminated. The thorax is very ample, semiorbicular, of the shape and nearly the size of the apical half of the elytra, the basal angles are acuminated and slightly envelop the shoulders, the posterior margin is prolonged in the middle, towards the scutellum the foveæ or basal impressions are 2 and rather distant from each other. Scutellum obsolete. Elytra with 2 depressions at the base. Tibiæ straight ; tarsi with joints 1-4 subequal or very nearly so. Mesosternal carina middling.

V. *Memo. on the subject of Rain Gauges for the Provinces of Madras. By* W. H. BAYLEY, *Madras Civil Service.*

THE Rain Gauge now in use is a Funnel of Copper, 12 inches in diameter, and is inserted in a chatty or any kind of vessel. When rain has fallen the water is emptied out into a copper cylinder, 8 inches deep, and 3 inches diameter.

As the diameter of the Funnel is 4 times that of the cylinder, the area of the former is 16 times that of the cylinder, so that when the rain water is poured into the cylinder, every inch deep shows $\frac{1}{16}$ of an inch of rain fallen, and a cylinder *full*, or a "measure" denotes $\frac{8}{16}$ or $\frac{1}{2}$ an inch of rain.

A dipping stick divided to inches and tenths is used to measure portions of the cylinder. One inch in the cylinder as before stated denotes $\frac{1}{16}$, or ·0625 of an inch of *rain* and $\frac{1}{10}$ of an inch deep in the cylinder denotes $\frac{1}{160}$ or ·00625 of an inch.

The Talook Officers are directed to enter in their Books, Measures, Inches and Tenths. And these are to be *reduced* in the Board's Office to inches and decimals of rain, by using the following Multipliers.

Suppose the Return is.

Measures.	Inches.	Tenths.
13	7	8

13 × ·5	=	6·5.........	Inches of rain.
7 × ·0625	=	0·4375......	do.
8 × ·00625	=	0·0520......	do.
		6·9875	Inches of rain fallen.

The objections to this plan are two;

First, the apparatus is made much larger than is required, one-tenth of an inch in the cylinder denotes $\frac{1}{160}$ of an inch fall of rain, whereas $\frac{1}{100}$ of an inch is the *utmost* we can want from such country Registers as these. In the next place, if there is at

all, a heavy fall of rain, the receiving vessel must be a large one, if the Funnel diameter is 12 inches. No ordinary bottle (which is the cleanest and best receptacle) will do, and the consequence is a chatty is used, which is porous, easily broken and awkward to pour from into a narrow cylinder.

The second objection is, that the Register is not intelligible generally to those who keep it, and the orders of the Board that the Registers are to be sent to them to reduce "Measures," "Inches" and "Tenths," give the idea, that the inches and tenths, are inches and tenths *fall of rain* which is not the case. It will also be seen that the reductions are tedious when they come to extend over several Reports. Every "measure" has to be multiplied by 5, every inch by ·0625, and every "tenth" by " ·00625.

Now I venture to suggest a form of Rain Gauge which will register accurately to 100th of an inch fall of rain, and which will be free from every objection urged against the present one. The Funnel is 4·97 inches in diameter, and its area is therefore, 17·33 *square* inches, therefore a fall of rain of one inch, is 17·33 cubic inches in the reservoir, which is simply a common quart bottle. The rain water is poured out of the bottle into a little tin vessel holding one fluid ounce, and each of these full denotes that $\frac{1}{10}$ of an inch of rain has fallen. A stick notched to a 10th of the depth of the little cylinder, will show how many *tenths* of water there are in the said cylinder, and each of these is equivalent to $\frac{1}{100}$ of an inch of rain, though for country work, a 10th of an inch (each cylinder full being $\frac{1}{10}$ of an inch) may be sufficient.

The diameter of the Funnel, is theoretically, 4·697 inches; but in practice, 4·65 is found sufficient. This is a little smaller than the theoretical diameter, because it is impossible to expect Native workmen to bend the mouth of a tin funnel, to a *true* cylinder.

The tin funnel is much cheaper than a copper one.

A wooden Gauge might be sent from Madras to each Cutcherry, to which the funnel might be fitted.

The quart bottle is more convenient than a chatty or earthern ware pot, and is quite large enough to suit any fall of rain in the Carnatic. It will run over if the fall is above $3\frac{1}{2}$ inches, but this

is a fall that hardly ever occurs even in a heavy monsoon in 24 hours, and the Rain Gauge is, of course, measured every 12 hours. The bottle is cleaner, more easily poured from than the vessels now in use, and always obtainable.

The small measuring cylinder was fixed at one fluid ounce, in order that it might be easily tested at any Hospital or Dispensary. A diameter of 1 inch, and depth of 2·2 inches is very suitable. It is very easy to discern its contents to *tenths,* and each tenth denotes the $\frac{1}{100}$ of an inch of rain.

Three or four of these Gauges were tried last Monsoon at the Madras Observatory, and gave results exceedingly near the standard Pluviometer.

I first saw a Rain Guage of this kind at the house of a Native Gentleman of scientific acquirements at Vizagapatam, but it was not quite correct as to dimensions.

Its cheapness, simplicity, and accuracy, should, I think recommend it for general use.

[Report upon Mr. BAYLEY's proposed new Rain Gauge, by Colonel SMITH Mint Master, Madras Engineers.]

The memorandum omits to mention one circumstance which is necessary to a clear comprehension of Mr. BAYLEY's proposal, and that is, that the Imperial fluid ounce consists of 1·733, or more exactly 1·7329625 cubic inches, consequently the fluid ounce measure necessarily represents the tenth part of the bulk of rain falling at the rate of one inch, in any given period, on an area of 17·33 square inches.

With this explanation I trust it will be evident that Mr. BAYLEY's proposed arrangement is as correct as it is scientific, and that its precise accuracy merely depends upon the truth of the workmanship and the care of the observer; which with moderate pains are not likely to cause error to a degree likely to interfere with objects aimed at by the use of these instruments.

In order to any practical trial, it would be necessary that five or six carefully made Gauges of the new pattern should be exposed during rainy weather, in company with a correct standard, and a

comparison of their respective indications made. This could most conveniently be done at the Honorable Company's Observatory, there being no such thing as a standard Rain Gauge in the Mint.

[Agreeably to Colonel SMITH's recommendation, 6 Rain Gauges answering to Mr. BAYLEY's description were ordered to be made up and tested at the Honorable Company's Observatory. The following is an extract of a letter from Major WORSTER, the Honorable Company's Astronomer with reference thereto.]

Several of these Gauges, &c. have already been tried with the standard Gauge of this Observatory, and as there can be no doubt whatever of the accuracy of the result if the rim is truly formed to the given diameter, it would appear to be an unnecessary loss of time in detaining the Gauges here when they could be more usefully employed in the interior.

Tin plate however can scarcely be formed on a mould to a truly cylindrical shape, and it would be far better to form the rims of brass and turned to the given dimensions, the tin funnels being subsequently soldered on to complete the Gauges. The expense of these rings would be but trifling.

Mean Diameters	
No. 1	4·696
No. 2	4·695
No. 3	4·683
No. 4	4·690
No. 5	4·692
No. 6	4·691

The six tin Gauges (with their measures) have been prepared, the diameters of which are noted in the margin.

[In order to judge of the advisability of substituting the improved Gauge for the less convenient pattern in use, letters on the subject were addressed to the different Collectors inviting their opinions thereupon. Colonel FABER, the Chief Engineer, upon the receipt of their replies, submitted to Government a concise narrative of the whole project, of which the following is an extract.]

The Collector of Malabar states that the jars used for receiving the rain water are glazed so that they are not open to the objection of being porous but that he wishes to have one of the new pattern for trial.

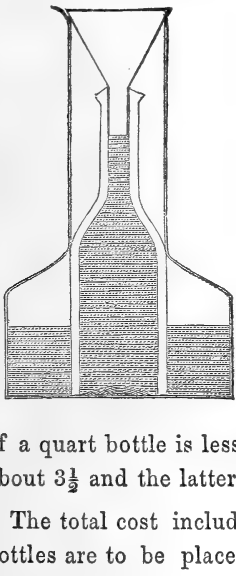
The Collector of Canara states that the new pattern will not answer on the Western Coast as 9 inches of rain have fallen in 24 hours at Mangalore.

The Collector of Nellore has written two letters on the subject; in the first dated 29th April 1856 he states that the Talook Officers are quite familiar with the pattern now in use, that the method of taking and registering the measurements causes no confusion of

thought and that the new gauge will not answer throughout every monsoon, as 8·25 inches fell on the 9th October 1852, and 10·7 inches on the 8th October 1855. He thinks however that a few gauges of the new pattern would be useful and asks for 4.

In his second letter No. 202 dated 8th July, he suggests that Mr. BAYLEY's improvement of dividing his measuring rod into 10ths should be introduced with the present gauges and points out the method of using it.

The total number of the new gauges asked for was 129, but as some of the Collectors who approved of the new gauge did not mention the numbers they required, I have the honor to recommend the manufacture of 180 gauges of the new pattern, substituting however a tin vessel to receive the rain fall instead of the quart bottle; or else placing the bottle in a tin cylinder so that if very heavy rain fall, so as to more than fill the bottle, the surplus water might overflow into the tin vessel as exhibited in the annexed drawing. This would answer very well, as the external diameter of a quart bottle is less than that of the gauge; the former being about $3\frac{1}{2}$ and the latter 4·697 inches.



The total cost including that for the tin vessels in which the bottles are to be placed would amount to Rupees 360 for 180 gauges.

It is far from being an uncommon occurrence to receive mistaken values of rain falls from Collectors using the pattern now in use, and I have frequently to send back the returns for correction month after month. The new stick suggested by Mr. Elton alluded to in his letter of the 8th July, and which I beg leave to forward for inspection is however a decided improvement, and to any one giving himself the trouble to think on the subject at all, it is difficult to believe that wrong values can be assigned to the measurements shown by the decimal scale. But it must be admitted that

Mr. BAYLEY's pattern is much to be preferred, and the suggestion contained in para. 10, which I owe to my Assistant Lieutenant O'Connell meets the solitary objection that has been, or probably can be, urged against the new apparatus, namely its insufficiency during the very heavy downpours frequent on the Western Coast, and of occasional occurrence throughout the whole Presidency.

[The Government approved of the new Rain Gauges and sanctioned the manufacture of 180, with the improvement suggested in the Chief Engineer's letter.]

SELECTIONS.

On the intoduction of the Cinchona or Bark-tree.

The attention which has lately been paid to the experiment of introducing the *Cinchona* or Bark-tree into India has induced us to re-produce an interesting article on the successful accomplishment of a similar attempt in Java which we have prefaced by a general review of the history of this valuable drug.

Dr. Forbes Royle, so long ago as 1840 had pointed out* that the bark yielding trees might be successfully cultivated in India and indicated the Neilgherry Mountains as being peculiarly suited for a trial.

In 1850 Dr. Grant, Apothecary to the E. I. Company, again drew attention to the subject, and in 1852 the Agri Horticultural Society of Bengal transmitted a paper by Dr. Falconer, Superintendent of the Botanical Garden at Calcutta in which he also urged a trial of the experiment. The proposal was favorably received by the Governor General and recommended to the notice of the Court of Directors, by whose orders a case of plants of *Cinchona calisaya* was transmitted to Calcutta under the charge of Mr. Fortune.

Of the six plants so despatched, five reached the Botanical gardens alive. They were kept for some months but did not ap-

* Prod. Resources of India, pp. 248, 425.

pear to thrive, and the cuttings taken from them all died. On the approach of the cold weather they were sent to Darjeeling, but three only reached the station alive and these survived but a short time, having been killed by the cold of the winter.

This can hardly be deemed a fair trial. The plants were too few in number. They were detained many months in the uncongenial climate of Lower Bengal. They were weakened by cuttings and change of place and then suddenly transported at the approach of winter to an elevation 6,000 or 7,000 above the plain in which they had passed the hot season and the rains. Accordingly the Medical Board of Bengal again addressed the Government of India† urging the prosecution of the experiment upon a more extended scale and recommending that it should be undertaken in situations better adapted to the natural habits of the tree, such as the Neilgherries and the hilly regions of Sylhet, Chittagong and the Tenasserim Provinces.

Of the result of this application we are not informed.

About the same period, the subject of the *Cinchonas* attracted the attention of the French Government. In 1843 M. de Castelnau having been appointed to conduct an expedition for scientific purposes into Central South America, M. Weddell was associated with him at the instance of the Musee D'Histoire Naturelle for the prosecution of researches in Natural History. His attention was directed to the investigation of several interesting subjects of botanical inquiry among which the history of the *Cinchona* occupied a prominent place. After working in concert with M. de Castelnau for two years, he separated from him and pursued an independent course of inquiry until 1848. It was during this period in 1845-47 that he obtained the valuable information regarding the *Quina* yielding trees which he has given to the world in his *Histoire Naturelle des Quinquinas* which forms the standard as well as the most recent work on the subject.

In the introductory chapter Mr. Weddell gives a sketch of the history of the drug previous to the period of his own discoveries.

† Indian Annals of Medical Science, III. 250.

The *Quina* Bark was first brought to Europe in 1640 by Juan de Vega, physician of the Conde de Chinchon to whom it had been sent in 1688 by an officer in the interior of the province, the Corregidor Don Francesco Lopez Canizares, but for a long time the tree which produced the drug remained unknown. In 1735 the Academy of Sciences having obtained the appointment of the commission to measure an arc of the meridian at the equator under the direction of M. de la Condamine, Joseph Jussieu was attached to it as Naturalist. He visited the forests of Loxa and Upper Peru from which the largest quantity of the febrifuge bark was exported and first ascertained that it was produced by the tree which has since been named *Cinchona Condaminea* by Humboldt. But unfortunately the results of his researches were never published. He did not return home till 1771 and then in a state of mental incapacity which totally unfitted him for literary labor. La Condamine however gave a general account of their discoveries in 1738.

For a long time the market continued to be supplied from this single source, but so great was the destruction of trees, 25,000 having, according to Humboldt, (1779,) been destroyed in one year, that the *C. Condaminea* became extremely scarce and the dealers having taken to adulterating the article with other barks, it fell into disrepute. The trade gradually diminished and Loxa itself sank into decay.

A new source of supply was opened by the discovery of several kinds of *Cinchona* in the forests of New Granada and a trade in barks sprung up at Carthagena after the middle of the last century.

The Marquis de la Vega appointed Viceroy of New Granada in 1760 was accompanied by Don Jose Celestin Mutis who earnestly applied himself to develop the resources of the province. He made known the existence of bark yielding trees in the vicinity of Santa Fe de Bogata and was appointed to the charge of the forests in which office he was found by Humboldt when he visited that part of S. America.

A few years later the Spanish Government having organized an expedition to explore the productions of their American possessions Messrs. Ruiz and Pavon were appointed to accompany it in the

capacity of Botanists together with M. Dombey, an able French physician. After continuing their labors for 11 years they published the results in the Flora Peruviana and in the Quinologia which appeared subsequently from the pen of Don Hippolito Ruiz. Their researches tended greatly to enlarge the existing knowledge of the subject. They established several additional species of the genus *Cinchona* and opened a new source of supply from the forests of lower Peru and Chili.

Much however still remained to be discovered and although additions to the stock of information left by them were contributed by Humboldt and Bonpland, Lambert, Pöppig, and others, it remained for M. Weddell to bring the subject in a comprehensive form before the public.

His first journey in search of the Cinchona trees commenced in August 1845. Proceeding through the Chequito country in the province of Bolivia he directed his course southwards towards the Rio Grande, crossed the Cordilleras to Tarija which he reached in January 1846 and determined the most southern limit to which the genus reaches, near the 19° of S. Lat. where it is represented by the *C. australis.* He then after the rains crossed the Andes to La Paz, the emporium of the bark trade of Upper Peru and in the course of his journey, identified for the first time the tree producing the *Calisaya* bark which he named *C. calisaya.* In the latter part of 1847 he explored the eastern slopes of the Andes and came upon some of the richest forests of *Cinchona* he had yet met with particularly those on the Rio Ayopaya and in the province of Yungas.

It was here that he obtained the most precise information of the mode of discovering, felling, barking, transporting and selling the *quina* barks, his account of which is well worth quoting.

" The name of *cascarilleros*," says M. Weddell, " is given to the men who cut the cinchonas in the woods ; an appellation equally applying to those who are specially engaged in this commerce. The former, and of these alone I will speak here, are in general men who have been brought up to this laborious occupation from their infancy, and are accustomed by a kind of instinct to guide them-

selves in the midst of the forest. Without any compass but that intelligence peculiar to man in a state of nature, they guide themselves as unerringly in these labyrinths as if they were surrounded by an open horizon. But how often does it happen that those less experienced in this art lose themselves and are never more heard of!

"The only period which is not suited for the collection of cinchona bark is the rainy season, which in duration corresponds in some respects with our winter. If some persons contend that the period of the ascension of the sap is the best for stripping the trees, their precepts are certainly not practically adopted, for even during the rainy season the collection of the bark is only suspended on account of physical obstacles to its continuance.

"The cutters are not generally engaged on their own account, but are mostly in the service of some merchant or small company. A confidential person is sent with them into the forests who is called the *major domo*. It is his duty to receive and examine the barks which are brought to him by the different parties in the forest, and to superintend the distribution of the provisions.

"The first thing done by those who engage in this kind of speculation in a region previously unexplored is to have it examined by experienced *cascarilleros*, who are called *diestros* or *practicos*. The duty of these is to penetrate the forests in different directions, and to ascertain to what points they may be profitably explored. They are expected to state whether there are any cinchonas, and in what quantity; also to point out the direction in which the trees are to be found, and to report on the quality of specimens of the bark obtained.

"This preliminary investigation is very important, and requires the possession of much sagacity, patience, and experience, in those who are engaged in it. It is upon their report that the chances of success are calculated. If it be favourable, a road is immediately commenced up to the point which is to form the centre of the operations; and from this time all those parts of the forest adjacent to the road become provisionally the property of those who have formed it, and no other *cascarilleros* can work there.

"On the arrival of *major domo* with his cutters in the neighbourhood of the part to be explored, he chooses a favourable site for his encampment, as near as possible to a spring or river. He constructs a hut or slight house to shelter the provisions and the produce of the cuttings; and if he anticipates having to remain for some time in the same locality, he commences the cultivation of maize and a few vegetables. Experience, indeed, has shown that an abundant supply of provisions is one of the most important conditions of success in this class of undertaking. The *cascarilleros*, during this time, are distributed through the forest, one by one, or in small parties, each carrying under a small cloak, and suspended at his back, provisions for several days, and the coverings which constitute his bed. In this way these poor beings have occasion to put in practice all their courage and patience in order that their work may prove fruitful. Obliged to have the hatchet or knife continually in his hand, to disembarrass himself of the numerous obstacles which arrest his progress, the *cascarillero* is exposed, from the nature of the circumstances by which he is surrounded, to an infinity of accidents which too often endanger his life.

"The cinchonas rarely constitute an entire forest, but form groups more or less compact, distributed in different parts of it. The Peruvians give these the name of *manchas*. In some cases, and most frequently, they grow separately. However this may be, it is in discovering them that the skill of the *cascarillero* is principally exerted. If the position be favourable, the tops of the trees first attract his notice; a slight movement peculiar to the leaves of certain species, a particular colour of the foliage, the aspect produced by a great mass of inflorescence, enable him to distinguish the cinchonas from a great distance. Under other circumstances he confines his inspection to the trunks, of which the external layer of the bark, or *enves* as it is called, presents remarkable characters. Very frequently the dry leaves which he finds on the ground are sufficient to indicate to him the vicinity of the object of his search; and if these indications have been brought there by the wind, he knows in what direction to look. An Indian, under these circumstances, is an interesting object for observation. Passing in and out through the narrow pathways of the forest, glancing through the foliage,

and appearing to sniff the earth, he seems to walk like an animal pursuing its prey, and darts forth when he thinks he has discovered the object of his search, nor stops until he has arrived at the foot of the trunk which he had descried from the distance. It is not always, however, that the exertions of the *cascarillero* are productive of such favourable results. Too often he returns to the camp empty handed, and without provisions ; and not unfrequently, when he has discovered on the side of a mountain indications of the tree, he finds himself separated from it by a torrent or ravine. Entire days may then pass before he can attain the object which, during this period, he allows not to escape from his sight.

" In order to strip the tree of its bark it is felled with a hatchet, being cut a little above the root, and the bark previously removed from this part, so that nothing may be lost ; and as at the base the bark is thickest, and therefore most profitable, it is customary to remove the earth from around the trunk, so that the barking may be more complete. The tree seldom falls immediately when cut through, being sustained either by climbing plants or by the adjacent trees ; these are fresh obstacles to be overcome by the *cascarillero.* I remember having once cut the trunk of a large cinchona in the hope of bringing its flowers within reach, and, after having felled three adjacent trees, had the mortification to find it yet standing, being held up by the interlacing creepers.

" When at length the tree is down, and the useless branches have been cut off, the peridermis is removed by striking it, either with a little wooden mallet, or even with the back of the hatchet ; and the inner bark, being thus exposed, is often further cleaned by means of a brush. The bark is then divided by uniform incisions circumscribing the pieces which are to be removed, and these are separated from the trunk with a common knife or some other instrument, the point of which is carried as close as possible to the surface of the wood on introducing it into the incisions previously made ; and if the position of the trunk prevents the operator from removing the whole of the bark by the first operation, it is subsequently divided so as to admit of its being turned. The dimensions and regularity of the pieces necessarily depend more or

less on circumstances ; in general, however, for the convenience of transport and facility of preparation, they endeavour to make them from fifteen to eighteen inches long, and four or five inches wide. The bark of the branches is separated in the same way as that of the trunk, excepting that it is not deprived of its exterior coating or peridermis.*

"* Formerly, with very few exceptions, the bark deprived of its peridermis was not received in commerce ; not that any virtue was supposed to exist in that part, but it furnished distinctive characters, by which it was easily known, and rendered difficult of substitution. The necessity which was thus imposed upon the *cascarilleros* of preserving this, in many cases, frail part, demanded on their part the greatest care. Thus in many places it was the custom to fell the tree two or three days before barking it, so that, desiccation having commenced, the different layers of bark might adhere together.

" I think that the removal of the peridermis from the surface of the thick barks at the time of cutting, is not quite general. Some of the cinchonas of New Granada, which I have recently seen, retained the outer coating. However this may be, we perceive the necessity of studying the bark under both aspects. I am persuaded that many museum specimens, collected at a period when it was customary to preserve the peridermis, would no longer be thought of doubtful utility, if considered in this point of view.

" The process formerly employed for separating the young barks from the wood, also differs much from that which is now practised ; hence there is a certain difference in the formation of the cylinders prepared by the two methods. I have already described the way in which it is now done, and it is easy to understand that by this method the dimensions of the separated pieces may depend on the patience or skill of the *cascarillero*, or on the circumference of the branch or trunk from which they are taken. Formerly, on the other hand, each piece was cut by one operation, the *cascarillero* holding his knife by the two extremities, and drawing it rapidly towards him. The flat pieces obtained in this way necessarily varied in width, according to the size of the trunk from which they were taken, and the quills when dried were frequently no larger than a pen. The pieces also had sharp edges, and they were thicker at the centre. The defect of this method was the immense loss which resulted, for nearly as much bark was left on as that which they removed, the former being considered useless on account of its being deprived of the peridermis. But this loss was as nothing when compared with that which I have next to notice. I allude to the almost entire rejection, for some time, of the bark of thick trunks. The loss resulting from this cause was immense. Many of those experienced in this subject having affirmed that with age the juices disappear by degrees from the bark, and that those barks only are efficacious which are taken from branches of moderate size, four times as many trees were sacrificed as would have been the case under other circumstances. It has been said, it is true, that the *cascarilleros* climbed the trees to

"The details in the process of drying also vary slightly in the two cases; the thinnest pieces of bark from the branches or small trunks, intended to make the quilled cinchona, are simply exposed to the sun's rays, and of themselves take the desired form, which is that of a hollow cylinder; but the bark taken from large trunks, which is to constitute the flat cinchona, or, as it is called, *tabla* or *plancha*, must necessarily undergo a certain degree of pressure during the process of desiccation, without which it would become misshapen, or take a cylindrical form as in the preceding case. To effect this, after first exposing the pieces of bark to the sun, they are placed one on the other in crossed squares, in a similar manner to that practised in timber-yards in the arrangement of the planks of wood, and on the top of this pile a heavy weight is placed. This process is repeated for several days until the bark is completely dried.

"The above process is that most commonly adopted in preparing the cinchonas; but it will be easily comprehended that this must vary, in some degree, according to the locality, or the nature of the tree operated upon. In many places the bark is not pressed at all, or but imperfectly so, and it is then generally out of form or slightly curled. The peridermis is often but partially removed, or simply scraped. Finally, whether it be accidental, or whether it be done with the view of augmenting the weight, there frequently remains a certain quantity of moisture in the bark, which greatly deteriorates it. It thus appears that cinchonas which would have presented the same characters if similarly prepared, may, according to the circumstances, vary very greatly. In any of these cases the labour of the *cascarillero* is by no means ended, even when he

cut off the branches, taking care to leave the terminal branch; but those whom I have known have always candidly confessed that they found the most simple method to be that of cutting the trees down, and this, I believe, has been the uniform practice Thousands of quintals of cinchona bark have been thus left to perish in the forests; and it has only been since the inutility of the practice has been proved by chemical analysis that it has been discontinued. It is not to be considered, however, that the bark of old trees contains as much of the active principle as those which have only arrived at maturity. There are limits between which all are good; indeed, none ought to be rejected.

has finished the preparation of the bark; he has yet to carry his spoil to the camp, and, with a heavy load on his shoulders, to retrace his steps along those parts which, while unburdened, he traversed with difficulty. The labour involved in this part of the operations can hardly be conceived. I have seen more than one district where the bark has to be thus carried for fifteen or twenty days' journey to get it out of the wood from which it was obtained; and considering the amount of remuneration received, I could hardly imagine men so unfortunate as to engage in work so laborious and ill-paid.*

"Something yet remains to be said with reference to the packing of the bark. It is the *major-domo* who performs this duty. As the cutters bring him the bark, the produce of their labour, he submits it to a slight examination, and rejects that which is bad. It is then, if necessary, exposed to a fresh process of desiccation, and formed into bundles of nearly equal weight, which are sewn up in coarse canvas kept for that purpose. In this condition the bundles are conveyed on the backs of men, donkeys, or mules, to the depôts in the towns, where they generally receive an exterior envelope, consisting of fresh hide, which as it dries makes a hard and compact package. In this form the packages are known by the name of *serons*, and it is thus that they arrive in Europe. The usual weight of a *seron* is from 70 to 80 kilogrammes (kilogramme 2 lbs. 3 ozs. avoirdupoise); but the weight is sometimes much less than this. From these details it will be seen how erroneous the notions of some persons still are with reference to the collection of cinchona bark; many having thought that it continues under special surveillance as it was formerly represented to be; and others that the cinchona-trees are cultivated in enclosed parks and treated as the cork-trees of our country. It must be acknowledged that the mode of collecting this valuable product appears to be always under the control of the half-savages by whom it is performed; and if some efficient means

"* In general, before the product reaches the coast it passes through at least three or four hands, and on each occasion its price is augmented; moreover, as carriage is very expensive, it follows that the price charged in Europe will afford no idea of its cost on the borders of the forest. At Pelechuco, for instance, 1 kilogramme (2 lbs. 3 ozs. avoirdupoise) is only worth a franc and a half (fifteen pence), and for this twenty francs are now paid in Paris.

be not discovered of counteracting the ruinous and wasteful method adopted, our descendants will inevitably have to regret the entire or at least partial extinction of the different varieties of cinchona.

"The opinion of those who calculate upon the forests being restocked from seeds, and from suckers thrown out from the stumps of the fallen trees, is more nearly in accordance with truth; but, as will be seen, even this source of renewed supply can only be depended upon to a certain extent. Too often the suckers, recklessly cut down, perish with the trunks to which they were attached; and the young trees, which very slowly attain to a certain degree of development, fall in their turn beneath the hatchet, never again to appear. The same may also be said of the seeds. A supervision and control exercised over the cutters, by means of inspectors, would, to a certain extent check this vandalism, but, unfortunately could not practically be carried into operation. The inspection of the woods in our country is a very different thing from inspecting a forest in the New World, especially if this forest cover 20,000 square miles.

"In fact, it appears to me that there are but two methods which could be adopted for preventing the rapid destruction of the cinchona trees. One is to limit the exportation to a quantity proportionate to the sustainable produce of the forest; the other, that of making the trees objects of regular cultivation. To limit the exportation would certainly be the most efficacious method; but is it not to be feared that the disproportion between the consumption and production is already too great to admit of the balance being thus restored? and moreover, are not our wants too pressing to give way to considerations effecting only the future?* There remains the cultivation, and this must be resorted to. If there be a tree which is worthy of being acclimated in a French colony, it is, certainly, the cinchona, and posterity will be grateful to those who may succeed in putting this plan into execution.

"* In support of this view of the subject we may cite the case of the Company of La Paz, to whom the Bolivian government conceded the monopoly of the commerce of the cinchonas of Bolivia, with the power of annually exporting 4,000 quintals, or 40,000 Spanish pounds. The restriction imposed in this case was

M. Weddell has likewise given interesting details of the present condition of the *Cinchona* forests and of the measures adopted by the Bolivian Government to regulate the trade. The discovery of quinine in 1820 gave a new impulse to the bark trade of Upper Peru from which province alone the *Calisaya* bark, yielding by far the largest proportion of quinine, is obtained. In 1830 General Santa Cruz, then President of the Bolivian Republic attempted to check the wasteful destruction of the forests by a series of ill-digested measures which only tended to aggravate the evil. In 1845 a monopoly was given to a commercial house, a principal condition of which was that the exports should not exceed 20,000 quintals (2,000,000lbs.) during the five years for which it was granted. The stipulation was not observed. Other monopolies followed and in the last two years of M. Weddell's stay (1849-50) the quantity of bark brought into the market from Bolivia alone was 3,000,000lbs. No wonder then that he foretells the utter extinction of the trade at no very distant period. It appears that the bark from the lower part of the tree is more valuable than that growing higher up. Many trees were observed by him in the course of his excursions, to have been barked only as high as the arm could reach. Others which had been cut down were stripped only on the upper side because the *cascarilleros* would not take the trouble to turn them! As a proof of the progressive diminution of the tree he cites the fact that whereas the *Calisaya* was, at a comparatively recent period to be found every where in the neighbourhood of the most populous tracts, it is impossible now to see a tree of 2 or 3 feet in diameter without penetrating several days' journey into the deepest parts of the forests.

never observed, and complaints have been made that the quantity allowed to be exported has been greatly exceeded. What would it be, then, if the restrictions were entirely removed, as they are in most other parts, and especially in Peru, where the exportation, during some years, has attained to an extent which is almost incredible?

" In New Granada, at the time when the commerce of cinchona bark was carried to the greatest extent, that is to say at the commencement of this century, the quantity exported from Carthagena alone amounted in one year, 1806, to the enormous extent of 1,200,000 pounds. In the present day, on the contrary, scarcely any is exported.

It does not appear that the French Government have founded any practical measures on the discoveries and recommendations of M. Weddell. But in 1852 the subject was taken up by the Netherlands Government and measures were adopted which have resulted in the successful introduction of the C. *Calisaya* into Java. The history of the experiment has been published by Professor De Vriese in a pamphlet of 122 pages, the substance of which is contained in the article with which we conclude the subject.

On the Transplantation of the PERUVIAN BARK-TREE *into* Dutch East India; *by* DR. DE VRIESE.*

"Were this notice intended for the learned world alone, it would be necessary to treat the subject more amply than is now attempted, as nothing more is desired than to enable the inquiring reader to understand what Quinquina is, its value to mankind, and the views that have actuated the Dutch in what they have done in this important matter.

"On some points of a scientific nature it has been necessary to be more diffuse than in other respects was desirable, as the greater part of the uninitiated (and who would misinterpret this term ?) are not generally acquainted with the specialities of natural and medical science; in other respects, conciseness has been necessary to avoid too great amplification.

"From the earliest scientific information we know that the inhabitants of South America have done nothing to hinder the unlimited collection, we should almost say robbery, of the Quinquina woods. No one thinks of their cultivation, and the Public Authority seems not to be interested in it, or is not able to be so: the latter, we should be disposed to conclude, when we consider, after Weddell, that the Quinquina district covers an extent of 2,000 square miles.

"We notice also that unheard-of quantities are exported; nay, what is more, now and then whole woods are burnt up. It may

* Extracted from a Work entitled 'De Kina-Boom uit Zuid-America overgebragt naar Java. Door W. H. De Vriese. 'S Gravenhage. (Translated by James Perrin, Professor of the English Language at Leyden.) 1855.'

be unknown to the Peruvians and Bolivians less than to Europeans, that the quantity diminishes, and that the trees, which are felled by thousands, are not so speedily succeeded by others that replace them. Whoever descends the Andes, to visit the woods in which the Quinquina grows, finds his way from the sound of the reckless axe of the Cascarilleros, as they mercilessly, in an unexampled manner, hew these beautiful trees. This rough handling is not alone working fatally for the future, but all accounts are unanimous that an incredible quantity of bark is lost in the most reckless manner.

"These circumstances have the sad consequence which De la Condamine foresaw as probable, and that all late travellers confirm, namely that there is a visible diminution in the quantity of Quinquina trees.

"Don Antonio de Ulloa,* thirty years after De la Condamine, uttered a warning against the destruction of the Quinquina woods, and proposed that strong prohibitive measures should be taken against their abuse. This, although very late, sixty-six years after, the Government of Bolivia considered, viz. in January, 1838; it issued an order against the exportation of Quinquina wood for five years.

"Pereira† makes the remark, that as these trees are produced but in one quarter of the world, and no care is taken of their cultivation, it is nowise to be wondered at that, this bark, in the course of time, should disappear from commerce.

"Stevenson‡ declares that if the Government of America do not take care to preserve the Quinquina-tree, either by forbidding the felling of it, or by obliging the authorities of the provinces to take strong measures to prevent the destruction of the tree, it is much to be feared that this excellent production of the New World will be wholly exhausted.

* Writer of 'Noticias Americanas,' vol. i. 1772, 8vo. See also Hooker's 'Companion to the Botanical Magazine,' i. 247.

† 'The Elements of Materia Medica and Therapeutics,' by J. Pereira, ed. 3, vol. ii. part 2, pp. 1605 *et seq.* London, 1853.

‡ Narrative of Twenty Years' Residence in South America, ii. 60.

" Weddell, in the Introduction to his 'Histoire Naturelle des Quinquinas,' says that his attention has been given to all sorts of Quinquinas. These are his words:—'L'immense accroissement pris par le commerce des Quinquinas dans ces parties, rendait en quelque sorte nécessaire un travail à leur sujet. A une époque aussi où la consommation de ces écorces, et surtout de leur principe fébrifuge, la Quinine, devient de plus en plus considérable, je crois qu'il peut être utile d'appeler l'attention sur les écorces qui un jour devront remplacer la Quinquina Calysaya, dont l'épuisement devient de plus en plus imminent. Ces espèces, si elles sont beaucoup moins riches en principes actifs, nous offrent encore, par leur abondance, quelque sécurité, contre la chance prochaine de nous voir privés du médicament le plus précieux du règne végétal.'

" Several Dutch naturalists, whose zeal in advancement of science for the good of mankind and the glory of their country is above all praise, have, for more than twenty-five years, urged upon the Government, both at home and in India, the transplantation of the Quinquina-tree from South America to Java. Those gentlemen have been Messrs. Blume, Korthals, Reinwardt, G. J. Mulder, Miquel, Fromberg, Vrolik, and others.

" It will be superfluous to say that successive Ministers for the Colonies have considered these propositions, and all who were officially called to it, and could throw light on the subject, have shown their interest in, and their desire for, the accomplishment of this object.

" Some of these naturalists have thought it probable that after some years, if the Quinquina-tree should be exhausted in South America, the culture of it might succeed in Java. Others have thought that neither pains nor money should be spared to transplant from Peru to Java a tree which would grow as luxuriantly there as in America.

" The desirableness of the transplanting was continually kept in remembrance; but the Government supposed the thing impracticable. The wish to obtain seeds of this tree, through the Dutch consuls in different States of America, was disappointed, the difficulty of obtaining them being so great, on account of the distance of their

stations from the woods of the interior of Peru, Bolivia, and New Granada. Seeds and plants were often promised by one and another, but these promises were not realized, although they were continually renewed. It was sufficiently clear that the only means to obtain seeds or plants of the Quinquina-tree was to send thither a proper person to fetch them.

" To find such a person was not easy. Various knowledge, botanical knowledge, and particularly an acquaintance with the Quinquina, were required. A great constancy and intrepidity in danger and in the difficulties of long journeys in foreign countries, and especially a strong constitution, would be requisite in one charged with so important a mission.

" Meanwhile the experience and information obtained by Mr. Weddell, in South America, were not lost to the naturalists of the Netherlands. His fame, but particularly his excellent writings, as well as the barks and dried specimens, collected by him in Peru, were not only known and appreciated here, but came freely into the possession of Dutchmen, and of their scientific institutions. In the Museum of Paris they were submitted to the inspection and research of the professional and interested with a praiseworthy liberality, of which the writer of this communication was able to bear witness during his sojourn in the French capital.

" In the month of June, 1852, the Minister for the Colonies proposed to the King, that a proper person should be sent to South America, to collect seeds and plants, and to transport them directly to Java, and he was empowered to despatch Mr. Justus Charles Hasskarl, late Botanist of the Botanical Gardens at Buitenzorg, Java, on the mission.

" The choice of so competent a man may in all respects be considered fortunate. Mr. Hasskarl, by a long residence on the Island of Java, had become accustomed to the influences of a tropical climate. He had a strong constitution, and was of middle age. For many years he had given evidence of a great love for the science, and a comprehensive knowledge of the Flora of Java. His numerous published writings evince great accuracy, perseverance, and

industry. His travels and investigations in India had furnished him with an uncommon measure of experience in travelling, particularly in overcoming the difficulties which so often arise out of the nature of a tropical soil.

" From his sound judgment and caution there was every reason to believe him particularly fit for this mission; it is not to be wondered at, then, that he immediately attracted the Minister's attention who proposed him to the King for this important service. Expectation was not disappointed, as the result has shown, for the object of Mr. Hasskarl's mission to South America has been attained.

" A plan was prepared and proposed, though he was left to his own judgment and prudence, and was only charged not to confine himself to the Calisaya Quinquina plant, but to collect as many as possible of the other sorts of Quinquina, which are found at various heights above the level of the sea. He was to go from Southampton to Charges, and so on over Panama to Guayaquil and Loxa, whence he was to journey inland. To save time, preference was given to the steam-voyage to Panama, above the longer one of doubling Cape Horn, which would have caused a delay of three months at least before the traveller could reach the places from which he would have to direct his course towards the interior of South America.

" On the 4th of December, 1852, Mr. Hasskarl left the Netherlands for Southampton, which he quitted on the 17th of December, on board the steam-boat La Plata, arriving at St. Thomas on the 1st of January, 1853; on the 12th, at Aspinwall, by Chagres; and at Panama on the 14th, just three days too late to continue his voyage by the steam-boat that touches at the ports on the west coast of South America.

" Being thus detained, he on the 25th continued his route to Payta, to go thence to Guayaquil. With the knowledge however that the rainy season would render his journey fruitless, he changed his plan and went to Lima.

" In the beginning of May he ascended the first, and then the second Cordilleras, thence he descended into the lower part of Peru.

Here it was that he saw, for the first time since leaving Panama, a luxuriant vegetation, but which however was far from being comparable with that of the last-mentioned country.

"To what difficulties such journeys are subject, may be generally known from the accounts of travellers in the pursuit of natural history; but it may not be uninteresting to the reader to be informed of Mr. Hasskarl's experience in that respect.

"The roads over the mountains of Peru are bad, mostly not broader than a bridle-path, and there are often on one side deep and dangerous precipices; it is impossible for travellers meeting to pass each other. When the crest of the second Cordilleras is passed, the traveller finds steps rather than roads. Here the way must be traversed on foot, the baggage being borne by Indians, if one is so fortunate as to find any. Setting forth on foot by Vitoc to Monohamba and Uchahamba, Mr. Hasskarl had the satisfaction to see the first Quinine-trees in their natural state, although these were not the Calisaya Quinquina, which are found in Southern Peru and Bolivia. Returning from Monohamba, across the second Cordilleras, he went to the capital of the province of Zanja.

"Near Uchuhamba Mr. Hasskarl saw a great number of true Calisaya Quinquina-trees but he was only able to collect a few of the plants and seeds. Of that good sort he collected a large quantity of seed, besides about fifty plants, which, after being packed with much difficulty, were sent from Lima to Holland on the 28th of July, 1853. This packet contained, besides seeds of '*Calisaya*,' four packets of '*Cinchona ovata*,' and a small quantity of '*Cinchona pubescens*.' In a letter to the Minister for the Colonies dated 12th August, Mr. Hasskarl sent a small bladder of seeds of the '*Cinchona amygdalifolia*.' After a voyage of about a month and a half, these objects arrived in a good state at Lima. They were addressed to some one acquainted with their culture, and by him packed in Wardian cases, and despatched to Panama. Owing to a misunderstanding of the carrier, they were detained there; and when, after experiencing the influence of a tropical heat, on arriving at Lima, all were dead. Here we had to lament the loss of the soil in which those plants were set in the cases, which, if it had

been chemically examined in this country or in India, might have thrown some light on the culture. However the seeds arrived safely, and were consigned to the Directors of the Botanical Gardens of the Universities, and at Amsterdam. We shall revert to these seeds later. From Uchuhamba the traveller went more southerly, where the people, who had revolted against the Government, and declared themselves free, not unfrequently threatened his life, for they looked upon him as a spy of the Peruvian Government. Often, and that too in the night, wholly and suddenly forsaken by his guides, was he obliged to wander about, without the most necessary food, to seek his old track, being whole days without seeing a human being.

"The opinion that the Quinquina-trees are found together in woods, growing, as it were, in company, is again, by the experience of Mr. Hasskarl, refuted. They are often scattered, and sometimes, even in the Quinquina districts, very difficult to find. Can the contradiction which, in these statements, exists between the earlier and present writers, be explained by the destruction of the woods, which has taken place during the last half century?

"Arrived in the province of Caraboya, he cherished the hope that he should there find the Quinquina-trees still full of fruit and seed, and *that* from information given him. This hope was disappointed, as the seeds were already scattered.

"In the latter end of September, 1853, Mr. Hasskarl arrived at Cuzco, the old Inca town. Passing from there to Sandia, the capital of the district of that name, where alone the Quinquina, as far as Peru is concerned, is collected, he put himself in connection with some old and experienced bark collectors (*Cascarilleros practicos*), to obtain information, and to make inquiry concerning the places where the Quinquina-trees grow. Thus he was enabled to see a great number and variety of the Quinquina species, but it was his misfortune to discover that he had come too late to collect seeds, for the fruits remaining on the trees had already dropped their seeds. It may not be improper to remark here that the Quinquina seed is extremely fine and light, and surrounded by an exquisitely fine membrane, so that it is easily blown away and lost, but also,

that to this cause may be traced the wonderful extent of the Quinquina-trees in South America.

"It was even less possible at that time to obtain young plants of those trees. In Caraboya however the trees were very scarce, much scattered, and thus rare, as the Cascarilleros had grubbed up all the old or seed-bearing trees. It is therefore often necessary to cross the great river, and thus to go over the boundary of the country of the wild Indians, with a faint hope of success, to look for these trees, and find scattered here and there in the woods, young plants that have grown up from seeds.

"In this manner, being disappointed in his expectation that his journey would be finished with 1853, he determined to return to Lima, and pass the rainy season there till April; however he changed this place, where, in the meantime, the yellow fever had broken out in a severe form, for Chili, where a cooler climate seemed to promise the restoration of his impaired health and strength. Advices from the Netherlands induced him to settle at Arequipa, where he was expecting to receive news of a score of Wardian cases which he bought at Lima, being forwarded to Islay. Having received this advice, he determined to go to a distance of 150 Spanish leagues into the interior, to make further investigations.

"A series of difficulties however presented themselves, which rendered the obtaining of Calisaya plants almost impossible. Peru and Bolivia were at war with each other. In the former year, the frontiers of the latter were wholly forbidden to the Peruvians. Mr. Hasskarl however believed that the restraint had been removed, with the exception of a small port on the "*desaguadero*" (outlet), lying at the south corner of the Lake Titicaca, which favourable change might have been brought about by the departure of the Peruvian armies, under the command of Echinique, to reduce Arequipa, where the insurgents had ranged themselves under the banners of Castilla.

"Bolivia was the country to which his attention was particularly directed, for there, according to the information, right or wrong, he had received, the Quinquina-trees were not so widely spread, but in certain places, called "*manchos*" appear in great numbers,

and grow much higher. If he might be fortunate enough to penetrate into the more deeply situated districts of Bolivia, the chance of collecting seeds and plants was not unfavourable, as the Calisaya of Bolivia, which is collected here, is the Quinine Bark *par excellence.*

" The frontiers of Bolivia were soon reached. Mr. Hasskarl was soon at La Paz, not far from the snow-mountain at Lutchis, a Bolivian frontier village, where he learned that the military order, forbidding the passage of the frontier, had not been revoked, as he had been erroneously informed.

He was thus obliged to determine to retire on the Peruvian territory, which he did, with the plan of going to Sandia in an easterly direction, keeping along the Bolivian frontier. With what pains and difficulties this expedition was attended can scarcely be conceived, unless we gave the detailed account furnished by himself, which our present space forbids. At the frontier places of Peru are often found Bolivians, who are generally Cascarilleros. For these the passage of the boundary was not forbidden, as it was for the Peruvians. They carry on their trade, have their families and abodes in Bolivia; they export all sorts of objects-or produce, and were not only disposed to serve Mr. Hasskarl, but they afforded all wished-for help, so that he was (naturally for an equivalent) very quickly supplied with plants by some, with seeds by others. Awaiting these, he went from one frontier place to another, and at last reached the above-mentioned Sandia, which he determined to make his head-quarters, and to which the objects to be delivered were to be forwarded at an appointed time, that he might pack them. He determined also to visit the places deeper inland himself, and to study, as much as possible, the Quinquina Calisaya.

" Meanwhile, the agreement with the Bolivians for plants and seeds of Quinquina-trees, for which provisions and strong drinks were given to those people, to load their mules and to serve as barter, was fulfilled, and by this means he really succeeded. While Mr. Hasskarl was gone from Sandia eastwards, one of the Bolivians arrived with a very considerable number of plants. Having

received information of this, he returned speedily to Sandia to secure all, that the plants might not suffer from the air and heat. On arriving, he found about 400 Calisaya plants, although not all of the strength for which he had agreed. The person who brought them must have had a very difficult journey to arrive at Sandia with this precious cargo.

"We shall not here enumerate the difficulties and dangers with which Mr. Hasskarl and that precious burden had to contend before he had accomplished a distance of 150 leagues, to bring those objects in a safe state to a place of shipment. The necessary means were contrived and put in action to obtain the seeds promised, but in this he was not able to succeed. The person who had undertaken to secure them, and to follow him on his arrival at Sandia, to Arequipa and Islay, and for which sufficient travelling expenses were allowed, did not come; at the same time, the interest that was felt in keeping the plants alive did not admit of delay.

"In the packing of the plants several circumstances required attention; first, the plants were to be made sufficiently damp to be able to reach the coast without drying up, notwithstanding the strong drying winds, and the almost perpendicular rays of the sun. Particularly was it necessary to protect them against this last, against the great warmth during the day; while on the other, it was equally necessary to guard these precious objects against the other extreme, the cold of the evenings and nights, which on those mountains is sufficiently severe. Just in the months from June till August, the water on the high table-lands (particularly at night) is frozen to ice. If it had been the aim of the indefatigable traveller to transport the plants set in *earth*, the weight, and the consequently increased number of beasts of burden, would have caused more hindrances; the plants themselves, but particularly their roots, would certainly have been injured by the continual shaking of the animals. It was also necessary, in other points of view, to provide for the plants in such manner that they should not have to suffer; considering that large plants were difficult to preserve from the injurious external influences before mentioned. The sprigs were closely packed together, with the roots in damp moss;

each packet was wrapped in the bark of Pisang stalks, and fastened with sackcloth, and made into small bales, somewhat resembling wool-bales, as those in which goods are forwarded on the llamas from the interior to the coast. The Pisang stalks necessary for this packing had to be fetched from the lowlands, on the shoulders of Indians; the moss, which did not grow at Sandia, was obtained in the mountain districts; all which, on account of the awkwardness and laziness of the Indians, cost much pains, time, and money.

" But with the greatest difficulty was the necessary rope obtained. Four persons were sent into the lower woodlands to collect bark, and work it up so as to serve for rope. Strong cords were required to bind the packages on the beasts of burden; these were ordered at Cruzero, and in this Mr. Hasskarl met with cordial cooperation. The collecting of so many mules in this solitary and out-of-the-way place was no slight matter: they were weak animals that could not carry half the weight the mules of Arequipa were able to bear on their backs.

" After a legion of difficulties of divers kinds, too many and too various to sum up here, the expedition started from Sandia on the 8th of June.

" It seemed however as if the difficulties would never come to an end. The animals were driven forward as fast as possible, but it was necessary, for the sake of the plants, to shorten the way as as much as it could be. From early in the morning till late in the evening they travelled on, almost without interruption, to leave the hill-country, with its extreme changes of temperature, behind, and to get as far off the highway as possible, that the cavalcade might incur no risk from the numbers of troops, who took possession of all transports as contraband of war, and that the plants, which were threatened with many dangers from that cause, might arrive in safety.

" Arrived at Azangora, they learned that no beasts of burden were to be obtained, as they were all required by the insurgents belonging to the party of Castilla, to carry muskets brought from Bolivia to Cuzco; whereas other drivers had taken the district of

the mountains, to avoid being compelled to a like service for the corps of General Roman, who was on the way from Puno to Cuzco. It appears that the strife of the two Republics against each other, and the troubled condition of the contending parties, caused the indefatigable and courageous traveller many difficulties, and almost occasioned the failure of his mission.

"We will not now follow him in the enumeration of his disasters, but only say that, not counting five days when he was detained by meeting with the soldiers, he, by means of forced marches, accomplished the journey from Sandia to Arequipa in a week; thence, embarking on a ship ready for sea, he went by Islay to Callao, and thence direct to Java.

"It seemed as if the courageous traveller must encounter new difficulties at the end of his mission. Islay was again in possession of the party of Echinique. An attack for the conquest of Arequipa was preparing there. But the means of transport were wanting. Mr. Hasskarl required many beasts of burden to transport his packages. To obtain these there was no sort of prospect. It was feared, and, as it appeared later, not without reason, that the animals would be seized. The profits of the expedition were not an equivalent to the risk the drivers feared they should incur. The party of Castilla, which was uppermost in Arequipa, moreover, did not permit the departure to Islay, and the one danger brought on the other. At last, when damages for the possible loss of the beasts was promised in case of need, and some persons of influence in Arequipa placed themselves in the breach for Mr. Hasskarl, his desired departure was allowed. On the journey to Islay nothing important happened, but at that place however the beasts were immediately pressed into the military transport service. The Wardian cases were arrived at Islay, but the frigate did not appear till a fortnight afterwards; this induced him to depart for Callao on a vessel going thither in ballast. In three days he arrived there. On the passage Mr. Hasskarl, unpacked his Quinquina plants, which he was able to do without interruption. He had reason to congratulate himself on their state, though they had been for more than four weeks shut up from light and air, when cutting

through the stems a fresh colour appeared. He immediately planted them in convenient cases. On the 7th of August, late in the evening, he arrived at Callao, and on the 27th he was ready to set out for Java, having passed the interval at Lima.

"As soon as the cooler west coast of South America was left, the heat began to increase daily, so that during the greater part of the day the thermometer marked 80° to 86° Fahrenheit. This made Mr. Hasskarl very careful of his plants, which, from his observations have in their natural position a temperature not above 60°, and generally below 50° Fahrenheit, and sometimes even at freezing-point. The objects had much to suffer in this heat, which must have been injurious to them, since they had made, including the transport from Bolivia, a land journey of six weeks. Shades of tents, etc., might ward off the sun's rays, but the glass cases were daily obscured with steam inside. The cases were opened, to clear away the mildew that had collected in them; and it was found good to repeat the operation daily. The mildew was continually renewed, and had to be taken away. At the beginning of the voyage, and after leaving the Sandwich Islands, the cases were inspected, and those that required water were supplied with it, however very sparingly.

"The stronger plants only began in any degree to sprout; the others showed no signs of doing so, although the stems evidently retained life. Some of them during the voyage began to shoot out at the root, whereas of the weaker plants, the parts above the soil appeared to be dying off, although it was apparently to be expected that they would shoot later. It was thought advisable not to endanger the plants by an untimely inspection, or loosening of the soil.

"We were informed, under date of the 22nd of December, 1854, that Mr. Hasskarl had arrived at Batavia on the 13th of that month, with twenty cases containing Quinquina plants, and at the same time, that a longer delay at Callao was caused by the difficulty of obtaining provisions and fuel; further, that at about 150 leagues from the Philippine Islands, the ship had encountered a dreadful hurricane, and had suffered much damage. They arrived at Ma-

cassar on the 3rd of December. As a long voyage now was considered bad for the plants, Mr. Hasskarl took his collection on board a steamship stationed there, and arrived at Batavia on the 13th, as mentioned.

"Measures were immediately taken by the Governor-General to transport the plants to the higher-situated Tjippannas, in which, however a delay of two days was occasioned by the tempestuous weather.

"Mr. Hasskarl, on his arrival, was charged with the cultivation of the Quinquina at Java.

"We have mentioned some seeds sent by Mr. Hasskarl to the Netherlands. The consequences thereof are to be considered as resulting directly from the mission carried out by that gentleman, and what is to be said of them will find an appropriate place here.

"Seeds of various sorts of Quinquina have successfully been received at the Colonial office as follows:—

1. "*Cinchona Condaminea*, Lamb., var. *δ, lancifolia*, Wedd. (*C. lancifolia*, Mutis), collected in new Granada, and presented to His Majesty's Consul-General there, Mr. Lansberge, by the famous traveller Karstens. From these seeds a few plants have been raised in the Academical Garden at Leyden. From Mr. Hasskarl were received—

2. "*Cinchona amygdalifolia*, Wedd. Sent immediately to Java per Overland Mail.

3. "*Cinchona Calisaya*, Wedd., from the Valley of Sandia, in the province of Carabaya, in Peru. Of this sort a quantity was sent, immediately on its arrival, by post to Java; another quantity was sown in the Botanical Garden.

4. "*Cinchona Calisaya*, Wedd, var. *β. Josephinæ;* sown, but come up badly in the Garden at Leyden.

5. "*Cinchona ovata*, R. et. P. (*Cascarilla crispilla*, *rhiqua* or *chiqua)*. We were informed that this, like No. 4, grows as a shrub in the neighbourhood of Hohubamba (Peru), 5-6000 Paris feet, on sunny slopes; whereas No. 5 grows at 6-7000 feet in high woods, and even on slopes in a mouldy soil, more or less mixed with

mica-slate, which circumstances were taken into consideration in laying the seed to germinate, and in the raising of the plant.

"The seeds received (with the exception of those sent directly to Java) were immediately distributed by the Minister for the Colonies to the Directors of the Botanical Gardens of the Universities and of Amsterdam, to be germinated, and further cultivated. It will be unnecessary to mention that these directors, deeply impressed with the importance of the matter, used every effort to make these objects answer the views of the Minister. In the beginning of 1854, and since, in 1855, his Excellency, even a short time after the sowing, received fiom the Botanical Gardens favourable reports concerning the germination.

"With reference to the seeds that the Minister sent by the Overland Mail to Java, to be sown, favourable advices have been received from the Governor-General (see lower); which last circumstance induced the Minister to request the return of the seeds from the Gardens in the Netherlands, and to send them likewise by Overland Mail to East India. It will be readily seen that the Minister, in trying and promoting the matter by all the means in his power, has had no other aim than that of assuring himself of the success of the intended transplanting. The Quinquina plants raised in the Gardens progressed in their development so much, that even in 1854 some were sent to Java. This really took place, and they were sent from Leyden, Utrecht, and Amsterdam.

1. "From Leyden plants of *Cinchona Calisaya.*

2. "From Utrecht, plants of the *Cinchona ovata.*

3. "From Amsterdam, plants of *Cinchona Calisaya* and *Cinchona pubescens.*

"Of No. 1 favourable reports have been received; of No. 2 such are still expected.

"Could there possibly be a doubt as to the correctness of the naming of the sorts of those received from Mr. Hasskarl under the name of '*Cinchona Calisaya,* Wedd'? I think not. The Government had sent a thoroughly competent person, and one who, by a long expe-

rience in the investigation of nature, had become a clever botanist, and whose writings testify to his strict exactness and scrupulous nicety in the smallest particulars; his love of truth is above all praise; his special knowledge of the subject must be a guarantee against all mistake. With such security for my conviction, I thought to be able, *à priori*, to foresee, that from the seeds which the Government has been pleased to entrust to the Botanical Gardens, if they germinated, no other plants than the Calisaya Quinine-tree would appear, under which name I received them.

"The result has not disappointed the expectation. The Quinquinas here developed are *Calisaya* plants. A strict inquiry has proved this to me as certainly as science only can.

"Under date of the 21st of October, 1854, the Governor-General informed the Colonial Minister that a great part of the Quinquina plants had attained such a growth that they could be planted out in a regular garden. Later advices concerning the planting out do not inform us of the preservation of the greatest number of the plants which came up from seeds at the Tjibodas, but this was not to be expected; this has nowhere, or never been the case with transplantation. Experience yet teaches us that plants produced from seeds do not always grow up and remain sound.

"The result of the culture of the Quinquina, under the direction and care of Mr. Teysmann, as well those obtained from seeds of Mr. Hasskarl, as those sent on former occasions from Leyden and Amsterdam, is as follows:—

"In the beginning of the month of November, 1854, Mr. Teysmann went to Tjipannas to prepare the ground for the transplanting of the Quinquina plants there.

"The ground which Mr. Teysmann judged proper for the purpose was then covered with heavy wood; this however being prepared, the transplanting began. It was about half a mile above the Garden of Tjibodas, perhaps 300 or 400 feet higher than this place, and consequently 4600 to 4700 feet above the level of the sea. The soil is very mouldy, with a porous, greasy, red subsoil, in which trees of colossal height, mostly 150 feet, with a diameter

of four to six feet, thrive luxuriantly, but which however are now cut down. The land lies to the north-west of the deep ravine of Tjibodas, on the slope of the Gedeh Mountains, and offers above, as well as below, good ground for extending the culture, provided that the woods be felled. The climate through the whole year, but particularly in the rainy season, is very damp, and the vegetation is at times wrapped in the clouds.

" To these are now to be added the *Calisaya* plants brought directly from Peru by Mr. Hasskarl, those sent by Willink of Amsterdam, those sent and yet to be sent from the Gardens of the University and of Amsterdam, and the plants which at different times have been sent from the Netherlands to East India, besides those which are yet to come up from seeds now there ; by which it may be computed that the plantations already made are, or will be in a short time, much more numerous than the success of the culture required.

" How well soever we may be convinced that all the care we can desire is given to the plants by Mr. Teysmann, it is not likely that the cultivation can be taken to heart better than by him who, on innumerable occasions, has risked his life in the countries from which he brought the living trees to Java. The observations concerning their growth, and the natural state of the places where they are found, can be applied to the culture at Java. Numerous particulars, which the most curious observer, who has not visited the original places where they grow, would pass by, are here brought to bear by the experience of Mr. Hasskarl. The long residence of that natural philosopher at Java, his acquaintance with the topography of the Island, with the elevations, table-lands, mountains and their slopes, the constitution of the soil, and the comparison of all these with those in the countries where the Quinquina grows ; this rich treasury of knowledge and experience, we are of opinion, enables us to look for success to attempts so well undertaken.

" With all that has already been said with regard to the measures taken by the Government, and the direct importation from South America by Mr. Hasskarl, we think it not improper to say a

little of what has been done by means of botanical gardens in the Netherlands, and by one private person, Mr. J. Willink, in the cause of this weighty matter, although those endeavours alone would not, in our opinion, have attained the object of the importation.

"From the Botanical Garden at Amsterdam the Professor Miquel sent several Quinquina plants to Java. The results of the sending out of a Quinquina-tree to Java in 1847, under the name of *Cinchona alba,* were very favourable. This tree, after having blossomed at Java, was called there *Cascarilla Muzonensis,* Wedd., or *Cinchona Muzonensis,* Gaud. Mr. Teysmann occupied himself with the management of this tree, which is a shrub, and quickly obtained from it more than a hundred plants.

"To promote the chemical investigation of this sort of Quinquina, a few branches were sent to Mr. Rost van Tonningen, then apothecary at the Government Laboratory at Batavia; an analysis of which, on account of the small quantity of bark, was not easy. There was no Quinine in it, but a resin which unmistakably had the smell of Quinquina resin, and deserved further inquiry as soon as a larger quantity of the bark should be obtained. He determined to make a second analysis, when the trees should be older, and he should have a larger quantity of the bark.*

"We remark here, that till now it is not known at what period the alkaloids develop themselves; and we may expect that a further analysis of the bark of this sort, furnished by the justly-celebrated Botanical Garden of Amsterdam to Dutch East India, will afford us a new subject of information. We may not omit to mention that, for our chemists in Dutch East India, a new field of inquiry is opening, which may be of great importance to the very difficult, and as yet imperfect, chemical history of Quinquina barks.

"From the Botanical Garden at Amsterdam, besides the exports made by order of the Minister, plants of *Cinchona Calisaya* were successively sent to East India,—as in April, 1851, six plants; December, 1851, three plants; July, 1852, four plants. Mr. Wil-

* The result of the inquiry of Mr. Rost van Tonningen was published in the Nat. Tydschrift (Batavia, 1852).

link, of Amsterdam, has also sent once or twice to Java, and thereby has shown his real interest in the good cause.

"In the Botanical Garden at Paris some plants of the *Cinchona Calisaya* had grown up from seeds, sent by Mr. Weddell from South America; part of these were sent to Algiers, the rest were kept at Paris. In 1851 I saw two plants in one of the greenhouses, which, I was assured, were the only ones left. These, as I guess, were from 2-2½ feet high, and were in a healthy state. It would have been indiscreet to have asked for one of those two plants; I learned however that there was one at Messrs. Thibaut and Ketelière's, which seemed to me the same. This plant was conceded to me, and was sent from Paris to Leyden on the 21st of July, 1851. It grew luxuriantly here, and in a few weeks attained a length of 75 inches; it was sent by the Minister's orders, in an apparatus expressly made for it, to Java, on the 1st of December, 1851.

"A letter from Batavia, 21st April, 1852, informed me that what I had sent had succeeded; for which, it appeared, that the minute care and the particular form of the apparatus were to be thanked. A few slips were immediately taken from this little tree; and the preservation of the plant was ensured, if unfortunately the chief stem should wither, for which, at first, there was some fear. The slips grew, and the tree also was preserved, to which its transplantation to Tjipannas certainly contributed.

"The last advices from East India, concerning this plant, sent from the Botanical Garden, stated that very favourable expectations were formed of it, and that it had already attained a height of 5½ feet. Will the cultivation at Java succeed? Will the soil, the air, the light, the degree of warmth, of dampness, and other atmospheric relations, lastly, will the particular situation, suit the culture? Will the plant there find, in a word, all that it finds in its native soil that is necessary for its development in its normal state, and there everything to form all that which makes it the most valuable of all medicinal substances that the earth anywhere affords?

" Of no new agricultural undertaking is the result to be considered as certain. The whole system of agriculture consists but in the exchange or transplantation of plants from one *place* to another. This holds good for the agriculture of all Europe, and we may say the same (as far as we are acquainted with them) for the other parts of the world; but this is particularly the case with the culture in tropical districts, and with European civilization in other parts of the world. The numberless host of crops of economical or technical nature belong, rarely, or never, by nature, to the lands in which we see them raised.* But those cultivated plants are just the most useful of the whole earth. We seek and find at last, without difficulty, all the circumstances that they require, if the plants are not wholly unfit for the change of air and soil, which quickly appears. Many plants for the commerce of Java, whose produce, that of some at least, brings large sums annually to the treasury, are not indigenous to that beautiful country, but have been brought to it from elsewhere,—Coffees from Arabia, indigo from Southern Africa, cinnamon from Ceylon, vanilla and nopal from Mexico, tobacco from America, rice from China and Japan, etc. Of some others the origin is no longer to be known. Other plants were originally there, but specimens of them have also been imported from other places, and they all succeed excellently. To expose all this in detail would be to communicate things already known.†

* Von Humboldt (and we cannot produce a greater authority) says in his Essay 'Sur la Géographie des Plantes,' p. 27: " L'homme, inquiet et laborieux, en parcourant les diverses parties du monde, a forcé un certain nombre de végétaux d'habiter tous les climats et toutes les hauteurs; mais cet empire exercé sur ces êtres organisés n'a point dénaturé leur nature primitive. La pomme-de-terre, cultivée à Chili à trois mille six cents mètres de hauteur, porte la même fleur que celle que l'on a introduite dans les plaines de la Sibérie. L'orge qui nourrissait les chevaux d'Achille était sans doute la même que nous semons aujourd'hui. Les formes caractéristiques des végétaux et des animaux, que présente la surface actuelle du globe, ne paraissent avoir subi aucun changement depuis les époques les plus reculées," etc.

† Humboldt says (p. 27), " C'est ainsi que l'homme change à son gré la surface du globe et rassemble autour de lui les plantes des climats les plus èloignés. Dans les colonies Européennes des deux Indes un petit terrain cultivé présente le café de l'Arabie, la canne à sucre de la Chine, l'indigo de l'Afrique et une foule d'autres végétaux qui appartient aux deux hémisphères." Others think indigo an

The Island of Java must be considered as having not high alone but also low temperature, and different climates, even if it be not known by experience. On one and the same island grow cocoa-palms and species of oak; from its plains to the different elevations are found all the varieties of vegetation which are met with from the equator to the temperate zones. The plains of Java furnish the tropical flora in all its varieties; and the heights, table-lands, and mountain-tops, the floras of Southern and Middle Europe. The plains of Europe present many floras agreeing with that of the Java mountain-tops, which are 9,000 feet higher.

"The progress of our knowledge of the geographical propagation of plants, and of that propagation in connection with the knowledge of the physical constitution of countries, offer a vast field for enterprise in the culture and transplantation of plants, which may sometimes be brought from distances of thousands of miles.

"The situation of many of the Quinquina districts being analogous to the geographical breadth of Java, must not be lost sight of. If this island does not present a like temperature in respect to the division of the quantity of sunlight, that mighty spur to vegetation, it will however give some analogy.

"There exists at Java a principal requisite, which is of the greatest importance, and which almost warrants success. It is this: a good result to the transplantation of the Quinquina-tree from its native soil to a foreign land, can only be expected if (except conditions of less weight) one principal condition be fulfilled, namely that the trees be not planted in any country beyond the tropics; as only in the tropics does a temperature sufficiently even and unvarying last during the whole year, and by which the free development of the Quinquina-tree is made dependent by nature, as it appears in the geographical extent of those trees in Bolivia, Peru, Ecuador, New Granada. For this reason, the countries without the tropics, as Algiers or the Himalaya Mountains, could

Indian plant, although from the different information and opinions we may deduce that the matter is uncertain. See Roxb. Fl. Ind. iii. 379; Wight and Arn. Prodr. p. 202; Royle, Ill. Himal. t. 195; Alph. de Candolle, Geogr. Bot. ii. 854.

never serve for the culture of the Quinquina-tree, because they lie without the tropics, and the difference in the temperature of winter and summer is too great to suppose that trees that have been used to an even temperature through the whole year, would thrive there. Similar elevations, with a climate constituted as nearly as possible alike, having the same variations by day and night, are to be found. On the mountains of Java, floras similar to those of the Quinquina-woods of Peru, may indicate the way, the place, the soil probably, where the Quinquina may be cultivated with good success.

"In the opinion of Dr. Junghuhn, the elevation for the culture of the Quinquina is to be found at 5000 and 6000 feet, or even higher, particularly as we can with confidence assert that, in America, experience has taught us that those sorts which are met with in the lower stations produce less Quinine, and are used by the Carcarilleros only to mix with the better barks.

"The experience at first acquired should plead for the correctness of the assertion of many Dutch naturalists, who have frequently raised their voices in this important cause, and for the merited confidence which was reposed in their opinions by the present Minister for the Colonies, M. Charles Pahud, under whose direction, doubtless to his own satisfaction, this matter was begun and has been so far successfully carried out; indeed the culture is already begun, as we think we have established in this communication; but particularly by advices from Java, by which we are informed that the culture of the Quinquina is so far advanced that they are of opinion that it is *impossible for it to fail.* These foreign plants have been so acclimated, multiplied, raised from seeds, planted out, and all with such good success, that the Quinquina plantation is reported as being in a very flourishing state.

"We are convinced that unless great and not to be foreseen calamities befall them, we shall in a few years see Quinquina plantations at Java yielding the best sorts of Peru and Bolivia. The number of trees which may be raised in a few years is incalculable; but if we take for the basis of our calculation, the fact that a small tree which arrived at Java three years ago, is now five feet and a half high, and has given off sixty striplings, then, in a few years, by a

proportionate continuation of the culture, the number of trees will be increased to millions.

"Thus we have succeeded in carrying out a matter in which the whole human race has an incalculable interest, and which was undertaken, not for the Netherlands alone, from thirst for gain or commercial speculations, but for the real benefit of mankind. We flatter ourselves that the Netherlands, on this account, may reckon on the approbation of the whole civilized world."

Supposed Aërolite in a tree.

We re-publish the following paper by Sir R. Murchison, from the proceedings of the Royal Society not only on account of the intrinsic interest attaching to the subject but as an example of careful induction and research applied to a singular natural phenomenon, and as an example of the caution with which conclusions should be drawn regarding the nature and origin of remarkable appearances in nature. Young and rash observers, particularly in India where access to books and well authenticated specimens is often difficult, are too apt to pronounce dogmatically on forms which meet them in the course of their inquiries. The care and circumspection exhibited by so eminent a philosopher as the President of the Geological Society in this investigation should serve as a warning against too hasty and confident a reliance on first impressions.

"In bringing this notice before the Royal Society, it is unnecessary to recite, however briefly, the history of the fall of aërolites or meteorites, as recorded for upwards of three thousand years, though I may be pardoned for reminding my Associates, that the phenomenon was repudiated by the most learned academies of Europe up to the close of the last century. The merit of having first endeavoured to demonstrate the true character of these extraneous bodies is mainly due to the German Chladni (1794), but his efforts were at first viewed with incredulity. According to Vauquelin and other men of eminence who have reasoned on the phenomena, it was in 1802 only that meteorites obtained a due degree of consideration

and something like a definite place in science through the studies of Howard, as shown in his memoir published in the Philosophical Transactions.

"Vauquelin, Klaproth, and other distinguished chemists, including Berzelius and Rammelsberg, have successively analysed these bodies, and the result of their labours, as ably brought together in the work of the last-mentioned author, is, that whilst they have a great general resemblance and are distinguishable on the whole by their composition from any bodies found in the crust of the earth, each of their component substances is individually found in our planet. They are also peculiarly marked by the small number of minerals which have collectively been detected in any one of them; nickel and cobalt, in certain relations to iron, being the chief characteristics of the metallic meteorites.

"Of the various theories propounded to account for the origin of these singular bodies, it would indeed ill become a geologist like myself to speak; and referring in the sequel to some of the various works in which the subject has been brought within formula, I will at once detail the facts connected with the discovery of this metalliferous body in the heart of a tree, as now placed before the Members of our Society, feeling assured that, whatever be their ultimate decision, my contemporaries will approve of the efforts that have been made to account for this singular and mysterious phenomenon.

"On the 2nd of June, a timber merchant, residing at North Brixton, named Clement Poole, brought the specimen now exhibited to the Museum of Practical Geology, when it occurred to Mr. Trenham Reeks, our Curator, that it might be a meteorite, and on inspecting its position in the mass of wood, and having heard all the evidence connected with it, I was disposed to form the same conclusion. On submitting a small portion of the metallic part to a qualitative test in the metallurgical laboratory of our establishment, the presence of nickel, cobalt and manganese was detected in the iron included in the mass, and as the surface was scorified, indented, uneven, and partially coated with a peculiar substance, the surmise as to the meteoric nature of the imbedded material seemed

to be rendered much more probable. Again, in looking at the wood which immediately surrounded that portion of the mass which remained, as it is now, firmly inserted in the tree, a blackened substance was observed to be interpolated between the supposed meteorite and the surrounding sound wood. On the outside of this substance (which had somewhat a charred aspect) we observed a true bark, which follows the sinuosities of the wood wherever the latter appears to have been influenced by the intrusion of the foreign mineral matter.

"Seeing thus enough to satisfy our conjecture, if sanctioned by other evidence, I desired Mr. Poole to bring all the fragments of the wood he had not destroyed which surrounded this body. On placing the ends of some of these (also now exhibited) on the parts from which they had been sawed off, they indicated that the space between the mineral substance and the surrounding sound wood widened upwards; the decayed wood passing into brown earthy matter with an opening or cavity into which rootlets extended. On interrogating Mr. Poole, who cut down the tree and superintended the breaking up of its timber, I learnt from him all requisite particulars respecting its dimensions, the position of the ferruginous mass, the quantity of wood above and below it, a description of the place where the stool of the tree was still to be seen, and of the parties who, living on the spot, were acquainted with every circumstance which could throw light on the case.

"At this period of the inquiry, the Museum in Jermyn Street was visited by Dr. Shepard, Professor in the University College, Amherst, United States, whose researches on meteorites are widely known, and who has furnished an able classification of them by which they are divided into the two great classes of stony and metallic. Having carefully examined the specimen, Dr. Shepard expressed his decided belief that it was a true meteorite, and the next day wrote to me the following account of it; at the same time referring me most obligingly to a series of interesting publications on the subject as printed in America and Europe* :—

* Dr. Shepard's numerous memoirs on meteorites are all to be found in the volumes of the American Journal of Science and Art, and in the same work the reader will find not only the general classification of these bodies by this author, who

"Concerning the highly interesting mineral mass, lately found enclosed in a trunk of a tree, and of which you have done me the honour to ask my opinion, I beg leave to observe, that I have no hesitation in pronouncing it to be a true meteoric stone.

"Aside from the difficulty of otherwise accounting for it, under the circumstances in which it is found, the mass presents those peculiar traits that are regarded as characteristic of meteorites. It has, for example, a fused, vitrified black coating, which is quite continuous over a considerable part of the mass, and contains several grains and imbedded nodular and vein-like portions of metallic iron, in which I understand nickel and cobalt have been detected.

"The general character of the body of the stone is indeed peculiar; and as a whole, unlike any one I have yet seen; it being principally made up of a dull greyish yellow, peridotic mineral, which I have nowhere met with among these productions, except in the Hommoney Creek meteoric iron mass, and which exists in it only in a very limited quantity. It is singular to remark also, that the stone under notice strikingly resembles in size, shape and surface, the iron above alluded to.

"The absence of the black, slaggy coating on one of the broad surfaces of the stone, may arise from its having been broken away, by the violence to which it must have been subjected in entering the tree; for it appears to have buried itself completely at its contact, an operation which would probably have been impossible, in the case of a stone, but for its wedge-shape configuration, and the coincidence of one of its edges with the vertical fibres of the wood.

possesses a collection from 103 localities, but also essays on the same subject by his countrymen Dr. Troost, Professor Silliman, jun., and Dr. Clark.

In our own country, Mr. Brayley published some years ago a comprehensive view of this subject in the Philosophical Magazine, and recently Mr. Greg has in the same publication put together all the previous and additional materials, with tables showing the geographical distribution of meteorites. Among the well-recorded examples of the fall of metalliferous meteorites, no one is more remarkable than that which happened in the year 1851, about sixteen leagues S. E. of Barcelona in Spain. In describing that phenomenon, Dr. Joaquim Balcells, Professor of Natural Sciences at Barcelona, has illustrated the subject with much erudition, whilst his theoretical views are ingenious in his endeavour to explain how meteorites are derived from the moon.

"In reply to a question I subsequently put to Dr. Shepard as to whether he knew of any examples of meteorites having struck trees in America, he replied as follows:—

"I think you will find in the volume I left with Mr. Reeks at the Museum, an account of the fall of Little Piney, Missouri, February 13th, 1839; in which it is stated that the stone struck a tree and was shattered to fragments, it being one of a brittle character. In the interior of the Cabarras country, N. Carolina, a stone (October 31, 1849) I know struck a tree, and I found it was difficult, indeed impossible, to separate completely the adhering woody fibres from the rough hard crust of the meteorite. The stone in this case is a peculiarly tough one, having a decidedly trappean character, rendering it as nearly infragile as cast iron."

"Aware that some time must elapse before the precise analysis, which I wished to be made in the laboratory of Dr. Percy, could be completed, and that the last meeting of the Royal Society was to be held this evening, I announced the notice I am now communicating. At the same time I resolved to visit the locality where the tree stood and to obtain on the spot all the details required. Having done so, accompanied by Mr. Robert Brown, Sir Philip Grey Egerton, Professor J. Nicol, and Mr. Trenham Reeks, the information ultimately obtained was as follows:—

"The man who helped to cut down the tree confirmed in every respect the evidence of Mr. Poole as to its position, height and dimensions, and pointed out to us the stump or stool we were in search of, which is to be seen at nearly 200 yards to the east of the St. George's Chapel, Lower Road, Battersea Fields, and at the eastern end of a nursery garden, between the railway and the road, occupied by Mr. Henry Shailer.

"The tree was a large willow, probably about sixty years of age, which stood immediately to the east of the old parsonage house recently pulled down. Its stem measured about 10 feet in circumference at 3 feet above the ground, and had a length of between 9 and 10 feet; from its summit three main branches extended, one of which, pointing to the S. W. or W. S. W. had been for many years blighted, and was rotten to near its junction with the

top of the main trunk; a portion of this blighted main branch is exhibited. The other two main branches, which rose to a height of 50 or 60 feet, were quite sound; a part of one of these offsets is also exhibited.

"The stool of the tree was visibly perfect and without a flaw, and at the wish of Mr. R. Brown, a section of it has been obtained since our visit, which is also here, and the rings of which seem to confirm the supposition as to the age of the tree.

"Mr. Poole having conveyed the tree to Brixton, cut the trunk into two nearly equal parts, intending to make cricket-bats out of each. In doing so, he perceived that the upper portion of the lower of the two segments was in a shaky or imperfect condition, and hence he resolved to saw off the upper part of it, intending thereby to obtain wood large enough for the "pods" of his cricket-bats, but not such entire bats as he was making out of the upper segment.

"In dividing the tree, the saw was stopped at about 8 inches from the surface on one side (or the breadth of a large saw) by a very hard, impenetrable substance, which was supposed to be a nail, and hence Mr. Poole resolved to break up the portion of the wood he had previously condemned as of inferior quality, and hewing it down from the sides he uncovered, to his astonishment, the great lump of metalliferous matter, as now seen. Attaching little value to it, much of the surrounding wood was thrown away or used up before the specimen was brought to Jermyn Street; but enough has been obtained to throw light on the probable or possible origin of the included mass.

"On interrogating Henry Shailer, a market gardener, who has long lived on the spot and managed the ground where the tree grew, when it was part of the garden of the former clergyman (Mr. Weddell), I learnt from him that he had known the spot for sixty years, that in his days of boyhood it was a fellmonger's yard, before it was attached to the garden. He had observed that the tree was blighted in one of its main branches for many years, and had always supposed that it was struck by lightning in one of two

storms, the first of which happened about 1838 or 1839, the other about nine years ago.

"So far the evidence obtained might be supposed to favour the theory that this ferruginous mass* had been discharged near to the blighted branch, and had penetrated downwards into the tree, to the position in which we now see it, charring and warping the wood immediately around it in its downward progress; whilst in the sixteen years which have elapsed, the wood renovating itself, produced the appearance which has so much interested the eminent botanists who have examined it, viz. Mr. R. Brown, Dr. Lindley, Professor Henfrey, Dr. J. Hooker, and Mr. Bennet.

"On the other hand, I must now point out some features of this extraordinary case which check the belief in the included mass being a meteorite.

"We found lying near the root of the tree two fragments, one of which is similar to the substance included in the tree, while the other is decidedly an iron slag. On bringing these fragments, weighing several pounds, to Jermyn Street, and on breaking one of them, it was found, like the supposed meteorite, to contain certain small portions of metallic iron, in which both nickel and cobalt were also present; and hence the scepticism which had prevailed from the beginning of the inquiry in the minds of some of my friends, was worked up into a definite shape.

"The occurrence of stones enclosed in wood is not a novel phenomenon. Mr. Robert Brown has called my attention to two cases as recorded in the following words:—

"De lapide in trunco betulæ reperto. G. F. Richter in Acta Phys. Med. Acad. Nat. Curios. volume 3, page 66†."

"Descriptio Saxi in Quercu inventi. Kellander, Acta Literaria et Scientiæ Sueciæ." 1739, pp. 502, 503.

* The ferruginous mass is, it is supposed, about thirty pounds in weight; but as one of its extremities is still imbedded in the wood, the precise weight cannot be stated.

† "Lapis prædurus subalbicans et manifeste siliceus pruni ferme aut juglandis minoris magnitudine. * * * * Nidus ad figuram lapidis non plane accommodatus, sed quadrangulus, et hinc illinc in mediocres rimas desinens, corticeque imprimis notabili, non multum ab exteriori cute diverso, maximam partem vestitus."

"Since the Battersea phenomenon was announced, Professor Henslow, to whom I had applied, wrote to me saying, that he possessed a remarkable example of a stone which was found imbedded in the heart of a tree, in sawing it up in Plymouth Dockyard; and he has obligingly sent up the specimen, which is now also exhibited. In this case, judging from the mineral character of the rock, and its being slightly magnetic, Professor Henslow supposed that it was perhaps a volcanic bomb. On referring it to Dr. Shepard, that gentleman entertains the opinion that it is also a meteorite, and states that it resembles certain meteoric stones with which he is acquainted; suspicions of which had also been entertained by Professor Henslow. From the examination of a minute fragment which I detached from this stone, it appears to be composed of a base of felspathic matter, with minute crystals of felspar and of magnetic iron pyrites. Externally it has a trachytic aspect, though, when fractured, it more resembles, in the opinion of Mr. Warington Smyth, a pale Cornish elvan or porphyry than any other British rock with which it can be compared. Whatever may have been the origin of this stone, which is of the size of a child's head, it is essentially different from the metalliferous mass from Battersea, to which attention has been specially invited, and its position in the heart of an oak is equally remarkable. Like the Battersea specimen, the segment of wood from Plymouth Dockyard is characterized by an interior bark which folds round the sinuosities of the included stone.

"In respect to the envelopment of manufactured materials in trees, my friend, Mr. H. Brooke, the distinguished mineralogist, tells me that he perfectly remembers the case of an iron chain which had been enclosed in the heart of a tree, the wood of which was sound around the whole of the included metallic body. This specimen was to be seen some years ago in the British Museum. Again, he informs me that at Stoke Newington he recollects to have seen a tree, the trunk of which had grown over and completely enclosed a scythe, except on the sides where its ends protruded*.

* Many other examples of extraneous bodies found enclosed in the heart of trees have been brought to my notice since this account was written. The most curious of these is perhaps that of an image of the Virgin, which having been placed in a niche had become imbedded by the growth of the tree around it.

"Whatever may have been the origin of the metalliferous mass from Battersea, its discovery has at all events served to develop certain peculiarities in the growth of plants which appear to be of high interest to the eminent botanists who have examined the parts of this tree which surrounded the supposed meteorite. Unwilling to endeavour to anticipate the final decision as to the origin of the body in question, I may be permitted to feel a satisfaction that its discoverer brought it to the Establishment of which I am the Director, and which numbers among its officers a Fellow of this Society, who is so well calculated, by his analytical researches, to settle the question on a permanent basis. Should the metallurgical analysis now under the conduct of Dr. Percy lead to the inevitable conclusion that the composition of this body is different from that of well-authenticated meteorites, and is similar to that of undoubted iron slags, we shall then have obtained proofs of the great circumspection required before we assign a meteoric orign to some of these crystalline iron masses, which though not seen to fall, have, from their containing nickel, cobalt and other elements, been supposed to be formed by causes extraneous to our planet.

"Postscript, 30th June 1855.—The following are the analyses above referred to which have been given to me by Dr. Percy since the preceding notice was read :—

"*The slag-like* matter (1) attached to the metal in the tree, as well as the similar matter (2) with adherent metal which was found by Mr. Reeks in the vicinity of the tree, has been analysed. The results are as follow :—

	No. 1.	No. 2.
Silica	58·70	63·52
Protoxide of iron	35·46	32·30
Lime	0·30	0·59
Magnesia	0·74	0·21
Protoxide of manganese	trace	trace
Alumina	3·40	2·85
Phosphoric acid	0·43	0·57
Sulphur as sulphide	trace	trace
	99·03	100 04

"No. 1. was analysed by Mr. Spiller, and No. 2. by Mr. A. Dick, chemists who have been incessantly engaged at the Museum during the last two years and a half in the analyses of the iron ores of this country, and whose great experience renders their results worthy of entire confidence. Cobalt and nickel were not sought for in either case, but the metallic iron enveloped in both specimens contained a minute quantity of cobalt and nickel. Another piece of slag-like matter, which was found on the ground near the tree, and which from its external characters I have no hesitation in pronouncing to be a slag, was examined for cobalt and nickel and gave unequivocal evidence of the former in minute quantity, though not satisfactorily of the latter.

"The metal previously mentioned is malleable iron. That which was detached from the slag-like matter, found outside the tree, was filed and polished, and then treated with dilute sulphuric acid. After this treatment, the surface presented small, confused, irregularly-defined crystalline plates, and was identical in appearance with the surface of a piece of malleable iron similarly treated after fusion in a crucible."

Colonel H. C. Rawlinson,

On the Results of the Excavations in Assyria and Babylonia.

These excavations, independently of the treasures of art disclosed by them, have opened up to us a period of about 2000 years in the world's history, which, as far as the East is concerned, was before almost entirely unknown. The cuneiform inscriptions of Babylonia and Assyria furnish a series of historical documents from the 22nd century B.C. to the age of Antiochus the Great. The speaker divided these documents into three distinct periods of history, the Chaldæan, the Assyrian, and the Babylonian, and he then proceeded briefly to describe each period in succession. During the Chaldæan period the seat of empire was to the south, towards the confluence of the Tigris and Euphrates, and the sites of the ancient capitals were marked by the ruins of Mugheir, of Warka, of Senkereh, and of Niffer. At Mughier, called in the in-

scriptions *Hur*, and representing the biblical *Ur* of the Chaldees, inscriptions have been found of a king, "*Kudur*, the conqueror of Syria," who was probably the Chedorlaomer of the Bible. At any rate, a king named *Ismi-Dagan*, who lived some generations later, is proved, by a series of chronological dates found in the Assyrian tablets, to belong to the 19th century B.C., so that the era of the earlier king agrees pretty well with the ordinary computation of the age of Abraham. The names of about twenty-five kings have been recovered of the ancient period, and there are good grounds for believing that the Assyrians did not succeed in establishing an independent empire at Nineveh till the early part of the fifteenth century B.C.

From B.C. 1273 to 625, the Assyrians seem to have been the lords paramount of Western Asia, and their history is preserved in an almost continuous series of documents, from the institution of the empire to the taking of Nineveh by the Medes and Babylonians. During the later part of this period, or from about 800 B.C., Jewish history runs in a parallel line with that of Assyria; and whereever a comparison can be instituted between the sacred records and the contemporary annals of Nineveh, the most complete agreement is discovered between them; and that not only in regard to the names of the kings, but also in respect to their order of succession, their relationship to each other, the wars in which they were engaged, and even the leading features of those wars. Col. Rawlinson noticed many such examples of coincidence, and drew attention to the great value of the verification which was thus obtained of Scripture history.

The third, or Babylonian period, was then shortly discussed; the reigns of Nebuchadnezzar and Nabonidus being especially selected for illustration. A description was given of the excavation of the great ruin near Babylon called Birs Nimrud, and a translation was read of the edict of Nebuchadnezzar inscribed upon the clay cylinders, which were found imbedded in the walls of the temple. A number of original relics, discovered among the ruins of Chaldæa, Assyria, and Babylonia, and illustrative of these three periods of history, were also exhibited to the meeting, previously to their being deposited in the British Museum.

LIST OF KINGS.

I. CHALDÆAN PERIOD.

Name of King.	*Approximvte Date.*
Urukh - - - - - -	B.C. 2234
Ilgi - - - - - - -	
- - - - - - - -	
Sinti-Shil-Khak - -	
Kudur-Mapula - - -	1950
- - - - - - - -	
Ismi-Dagan - - - -	1860
Ibil-Anu-Duma - -	
Gurguna - - - -	
- - - - - - - -	
Naram-Sin - - - -	
Durri-Galazu - - -	1700
Purna-Puriyas - - -	
- - - - - - - -	
Khammurabi - - -	
Samshu-Iluna - - -	1600
- - - - - - - -	
Sin-Shada - - - -	
Rim-Sin - - - - -	1500
Zur-Sin - - - - -	
- - - - - - - -	
Merodach-Gina - - -	
- - - - - - - -	
- - - - - - - -	1400
- - - - - - - -	
- - - - - - - -	1300
- - - - - - - -	

II.—ASSYRIAN PERIOD.

Name of King.	*Approximate Date.*
Belukh - - - - - -	1273
Pudil - - - - - -	1255
Phulukh I. - - - - -	1240
Shalama-Bar I. - - -	1220
Sanda-Pal-Imat - - -	1200
Asshur-Dapal-II. - -	B.C. 1185
Mutaggil-Nebo - - -	1165
Asshur-Rish-Ipan - -	1140
Tiglath-Pileser I. - -	1120
Asshur-Bani-Pal. I. - -	1100
- - - - - - - -	
Asshur-Adan-Akhi - -	950
Asshur-Danin-I. - -	925
Phulukh II. - - -	900
Tigulti-Sanda - - -	880
Sardanapalus - - -	850
Shalama-Bar II. - - (Asshur-Danin-Pal)	815
Shamas-Phul - - -	780
Phulukh III. { or Pul and Samuramit { Semiramis	760
Tiglath-Pileser II. - -	747
Shalmaneser (?) - - -	730
Sargon - - - - -	721
Sennacherib - - - -	702
Esar-haddon - - -	680
Aashur-Bani-Pal II. -	660
Asshur-Emit-Ilut - -	640 to 625

III.—BABYLONIAN PERIOD.

Name of King.	*Approximate Date.*
Nabopolassar - - -	625
Nabokodrossor (or Nebuchadnezzar) -	605
Evil-Merodach - - -	562
Nergal-Shar-Ezer - -	560
Nabonidus, and Bel-Shar-Ezer (Belshazzar)	554 to538
Taking of Babylon, by Cyrus.	

N.B.—It must be understood that the reading of many of these names is still far from certain. [H. R.]

Journal of Royal Institution, Vol. II., p. 143.

Flora Indica.

We regret to learn that this valuable work is likely to be arrested in its progress, owing to the want of encouragement on the part of the East India Company. Drs. Thomson and Hooker undertook the work at their own risk. The first Volume gives an earnest of what might have been expected at their hands. The authors are already well known to the scientific world by their botanical works, and every one acquainted with science is aware of their high standing and of their thorough competency for the task they have undertaken. The work is a national one, and promises to be one of the most important which has appeared in the botanical world. It will be the result, in a great measure, of personal observations, aided by the unrivalled resources of the Hookerian Herbarium. That such a boon to science should be stopped for want of funds, and that the authors should suffer pecuniary loss, is by no means creditable to our country. When the Admiralty have most nobly published the results of arctic and antarctic expeditions, it is surely not too much to expect that the East India Company, which is so much indebted to the labours of scientific men, should lend a helping hand in making known the vegetable productions of that vast territory over which they rule.

We think that all interested in science should unite in memorializing the Company on this subject, and we cannot for a moment doubt that the unanimous voice of scientific societies and scientific men will ultimately prevail.—*Edinburgh New Philosophical Journal, Vol. V., p.* 204.

SCIENTIFIC INTELLIGENCE.

Mines of Antimony.

On the table at the Home Office may be found some interesting correspondence relating to Mines of Antimony.

So far back as 1854, Major Hay brought to the notice of the Chief Commissioner of the Punjaub, that he had discovered on the great Shigree Mountain a vast deposit of metals in granite, one of

the principal being a Sulphuret of Antimony. In June 1855, M. Marcadieu, the Analytical Chemist, visited the locality, and while he acknowledged the richness of the mine, urged that placed as it is at an elevation of 13,507 feet, and covered for a great portion of the year with snow, no great commercial benefit could be anticipated from it. Major Hay, however was by no means discouraged, and determined to prosecute his researches, the results of which he communicated to the Deputy Commissioner of Kangra.

Six distinct beds of metal are now visible on the surface, three of which have been worked. Major Hay believes that the supply is inexhaustible, and the specimen sent to Dr. Macnamara for analysis, was found to contain so much as sixty per cent. of pure metal. It appears that owing to the dreariness of the locality, and other unfavourable causes, it would not be advisable to work the mines for more than three months in the year, and even during that limited period, the labourers would have to work under considerable disadvantages. Major Hay calculated that including every expense, the Antimony could be landed at Nuggur for two rupees per *pucka* maund; but he seems to have made no allowance for the impurities with which the metal must always be impregnated, and it is said that the three hundred and twenty *kucha* maunds lodged at Nuggur, probably do not contain more than one hundred and sixty maunds or sixty *pucka* maunds of pure metal. The Officiating Commissioner and Superintendent of the Trans-Sutlej States, is disposed to estimate the precise cost of the Antimony at Nuggur, after purification, at double or triple the price fixed by Major Hay.

With the view of testing the commercial value of the Antimony sent down, a meeting of the merchants of Julundhur trading in this article was called, and they assured Major Lake the Officiating Commissioner that in its then impure state, Major Hay's Antimony would scarcely find a market; that the sulphur with which it was impregnated would seriously affect its value, and that even under the most favorable circumstances, it would scarcely fetch more than four or five rupees a *pucka* maund. The Officiating

Commissioner was also informed that they could procure from a mine near Jugadree at four rupees a *pucka* maund, landed at Julundhur, an Antimony of somewhat inferior quality to that discovered on the Shigree Mountain, and also showed him a specimen procured from Reeanee near Jummoo, for which they paid as high as nineteen rupees a pucka maund. With this Antimony, it is said, Major Hay's specimens cannot be compared in quality, and if the relative distance of the two places be considered, the accessibility of Reeanee and the isolated position of the Shigree Mountain, the Antimony brought down from the latter place will not be able to compete with the Jummoo product in the distant markets of the Punjab. The Officiating Commissioner however, thinks it important to ascertain whether the Mines of Reeanee are sufficient for the wants of the Punjab, and if so, how it is that the Antimony of Europe and Candahar finds a sale. He states that he has been credibly informed that Antimony is now in less demand than it was in Europe, where it was formerly employed in all printing types, but by a recent invention leaden types capped with steel are used instead. He does not therefore anticipate any great commercial benefit from Major Hay's discovery, but considers that the latter is entitled to credit for prosecuting his researches with so much enterprise, and recommends that he be reimbursed all expenses to which he has been put in this attempt to develop the resources of the Koolloo Province.

Major Hay in a letter addressed to the Deputy Commissioner of Kangra, mentions that, towards the beginning of the last war it was stated, Antimony had been manufactured into cannon-balls, and had been found to answer better than any other metal; and that as the different scientific journals published the result, he apprehends " it was not a mere puff of the holders of Antimony to sell the metal ;" and suggests that there is nothing to prevent the mine being worked on so extensive a scale as to furnish all magazines in Upper India with shot made from Antimony.

A refusal of the sanction of His Lordship in Council however has recently been conveyed to the Chief Commissioner of the Punjaub to the working of the Antimony mines discovered by Major

Hay, on the ground that no material advantage would be derived from the undertaking. He is, nevertheless, pleased to acknowledge the exertions of Major Hay, and to authorize that Officer to submit a contingent bill for his *bonâ fide* expenses."—*Madras Spectator, March* 19, 1857.

Observations on the Graphite or Plumbago of Kumaon and of Travancore, by J. FORBES ROYLE, M. D.

Specimens of Graphite and Plumbago have on various occasions been sent from different parts of India and a desire expressed to have their value ascertained in this country,

Thus at the Exhibition of 1851, there were specimens from Almorah, Vizagapatam and Travancore.

The specimens from Travancore are in nodules extremely soft but brilliant, very like the Ceylon Graphite, of which some quantity has for some time been imported and sold for about £8 to £10 a ton. Some of the purer specimens of Travancore would rank with them, but all impurity greatly deteriorates its value. The Vizagapatam in its present state seems to be worthless.

Graphite has on several occasions been sent from Almorah as in 1849 and 1850, again in 1851 and lastly on the present occasion. It was first discovered by Captain Herbert near Almorah, who describes cutting it into slices of which he made pencils, showing that it had some of the qualities required in that substance. The specimens sent in 1849 and 1850 were examined and reported on by the late Mr. Phillips and also by the late Mr. Brockeden. The latter of whom was well acquainted with the practical uses and commercial value of Graphite, but he pronounced the specimens for any purpose that he was acquainted with as useless, and therefore worthless. The same opinion was again given to me by Mr. Brockeden before his death.

If the enormous value (from 30*s.* to 50*s.* a pound) of good Graphite, is considered, the declared worthlessness of these Indian specimens seems to be unaccountable. It is desirable to ascertain

what constitutes the value of good Graphite and what causes the deterioration of that from India. For this purpose it is necessary to notice the different uses to which this substance is applied. These are 1st for making pencils, 2nd to diminish the friction of machinery, 3rd to make fire proof crucibles, 4th to *black-lead* grates as it is called. For all these purposes except the last, it is evident that purity is essential.

The best pencils were formerly made of the Borrowdale Graphite, obtained from a mine which is now exhausted. This kind was pure and compact, and sold readily at about 40*s.* a pound. It was sawn into thin slices, these were inserted into the groove of one-half of Cedar Pencils and the superfluous part filed off, then the other half was glued on to the filled up half of the pencil. It is evident that for such a purpose only the purest specimens were of any value, for the presence of a bit of quartz or of an ore of iron or of any other metal would injure the tools and fracture the thin slices or slender prisms of Graphite, and if they did not produce any of these effects, they would be very inconvenient at the point of a pencil for whatever purpose employed. Indeed if it had not been for the discovery, that finely-powdered Graphite can by an extreme degree of pressure be rendered nearly as compact as the best natural Graphite, we should have been without any more good drawing pencils. But the Graphite for grinding though in small pieces, must be pure, or otherwise the grinding mills become injured, besides pencils made with it being unfit for use.

So also finely powdered Graphite is required for mixing with fatty substances in order to diminish the friction of machinery. It is equally evident, that this must be of the purest kind, or otherwise the machinery in which it was prepared, or that to which it was applied would be equally injured. Thus also if Graphite as an infusible substance, is required for mixing with the more infusible kinds of clay for making the best crucibles, the Graphite must be without impurities, as these would diminish the melting point and render the crucibles useless.

The Graphite or Plumbago, black-lead as it is commonly called and used for polishing grates, is an impure substance, but if

it has sufficient lustre it may be applied to such a purpose, but then it is always a low priced article.

Notwithstanding the unfavorable opinion entertained by Mr. Brockeden of the Graphite from Kumaon, I again submitted to him the specimens sent to the Exhibition of 1851, as well as those which had been forwarded from Travancore. He considered both as valueless, so Messrs. Reeves whose opinion I likewise asked accounted them "quite useless for the manufacture of black-lead pencils." Messrs. Wolff of Church Street Spitalfields who also make pencils, by first grinding and then condensing Graphite, took a more favorable view of the specimens, inasmuch as they could not conceive why pure specimens should not be found in the localities where both kinds had been collected. But they also observed, that they could not use the specimens in the state in which they had been sent, without damaging their machinery, and it would take time and labour, costing of course a good deal of money in this country, to separate the purer specimens from those which were intermixed with quartz or ores of iron.

Among the Travancore specimens however Messrs. Wolff observe many which are sufficiently pure for use, and if these were picked out in India and sent separated from the pieces covered and intermixed with quartz or iron ore, there is no doubt that it would sell in the markets for at least £8 or £10 a ton according to its purity and perhaps higher. As Trevandrum near to which the Plumbago is found is in the vicinity of the Sea and near a port like Cochin, there would be very little expense in land carriage and therefore freight would be the chief charge, but this might not be high as Plumbago is sometimes sent as ballast.

With regard to the Graphite from near Kumaon, Messrs. Wolff state, like Mr. Brockeden, that they cannot use it in the state in which it is sent in consequence of the quartzy sand and iron ore with which it seems to be intermixed. But from the internal purity of some of the Graphite in nodules, as well as from the appearance of the larger specimens they conceive that pure specimens of compact Graphite should be found in the same locality. But of this, those examining the localities themselves must

be better judges than those looking at bad specimens. It is certain that no specimens have yet been sent sufficiently pure to be sawn in slices or for grinding in the mills. The specimens last sent are valued at not more than £5 a ton.

Mr. Ruel celebrated for making crucibles (v. Jury Reports) considered that the specimens from Travancore were not worth more than 8*s.* a cwt. for his purpose though the price is sometimes as high, as 14*s.*

A good practical test I am told is that of chewing a small piece, when if not gritty, it will probably be found to be sufficiently pure for grinding up.

It is possible however that the enquiries now being made by Chemists may devise methods by which the impure specimens may be made available for purposes not yet generally known, I have been asked by one of our intelligent Chemists to ascertain the quantity in which the Travancore Graphite can be obtained and the cost per ton, at which it can be delivered on board-ship. It seems desirable therefore to forward a copy of this communication to Travancore as well as to Kumaon.

Extract from a letter from the Resident of Travancore and Cochin, dated 9th February 1857.

"Two varieties of Graphite are found in Travancore, one in their laminæ, another granular, and I sent specimens of both to the Exhibition of 1851.

"The granular or fibrous variety, I have only yet discovered in two localities and both of them in laterite, a few feet only below the surface. One locality is about 5 or 6 miles N. E. of Trevandrum and the other about 12 or 14 miles N. E., I brought in from this latter locality on my visit to it about 3 cwt.

"Some small deposits are also found immediately on the W. of the town of Trevandrum, but I have not yet heard of any other deposits of this granular variety, though I think it probable they exist.

"Graphite in thin scates or laminæ is common nearly throughout the laterite tracts of Travancore and Cochin, but more or less

abundant in particular places. It is found in some places in laminæ of considerable size, particularly in a laterite hill about 25 miles N. E. of Trevandrum at a place called Caviattencoodul, near the foot of the Ghât mountains.

"It is also found in laminæ of good size in the disintegrated gneiss of the Ghâts on the Tinnevelly side, also common in the Kunker or Travertine Deposits near Culdacoorchee and Ambasamoodrom.

"The Vizagapatam Graphite is perhaps also found in laterite, of which there is a large deposit at Bimlipatam.

"The objections made to the specimens of Graphite sent by me to the London Exhibition of 1851, were because of the impurities attached to it, but one motive in the selection of the specimens forwarded was to exhibit the matrix or laterite rock in which they were found."

Dr. Walker's report on boring for Coal at Kotah, a village 10 *or* 12 *miles from the jun ction of the Wurdah River with the Godavery, in the months of April and May,* 1848.

[The following paper was received from Hyderabad and communicated by the Chief Secretary to Government to the Literary Society for the information of Mr. Wall, the Coal and Mineral Viewer of this Presidency.]

In a paper published in the Journal of the Asiatic Society of Bengal for the month of June 1841, and to which reference is now made, I showed the probability of a coal bed existing on the left bank of the Pranheetah or Wurdah river, close to a small village called Kotah or Kotahpilly, about ten or twelve miles from the junction of this river with the Godavery, and sixteen miles N. W. of the large village of Mahdeopore.

Encouraged by the indications detailed in that paper, a boring operation was undertaken to ascertain the extent and position of the coal stratum, if such existed, the superintendence of which was entrusted to me.

The rods, drills and augers of the boring machine were made up at the Ordnance stores, Bolarum, and from the extreme dif-

ficulty in giving to steel at an up-country station the requisite hardness and temper it was feared by Captain FitzGerald, the Officer in charge of the Ordnance Department, that much obstruction to the work would be experienced in boring through the harder strata; that these apprehensions were well grounded, the result showed.

The boring machine reached its destination towards the end of March, but owing to the heavy rods, one and a half inch square, not arriving till the 4th of April the work was not begun in earnest till then, as the lighter rods of an inch square were found to be nearly useless and it was only by affixing heavy weights to the stronger rods that any progress was made. No difficulty was experienced in procuring coolies to work the machine for the moderate hire of a seer of rice and three small pice a day, they were divided into two working parties of eight or nine men each.

At Kotah, the river is about half a mile in breadth from bank to bank, and during the hot weather it is a large stream containing at least double the quantity of water of the Godavery and by a rough estimate is a couple of hundred yards in width. The alluvion on its left bank is of various depth, from 60 to 100 feet, and is composed of tough cotton soil with Chalcedony Jasper and other quartzose pebbles; towards the margin of the river the alluvion is much thinner.

In consequence of the tendency of this soil to fall in and by clogging the machine and filling up the bore seriously to impede the work, it was resolved to bore where it was as shallow as could be found, and this occurred in the immediate vicinity of the river ten yards from its biink.

The alluvion of 20 feet was pierced on the first day but so hard was the subjacent rock, composed of argillaceous limestone, and so frequently did the drill require repairs that it took nine days to get through a foot, from the 5th to the 12th of April; a specimen of what was taken up during that time accompanies this report and is marked No. I. On the 13th the rock became softer, and of a yellowish color and a foot and a half were pierced in three days, then followed a foot of blue clay when again the hard rock intervened,

and but four inches were got through in three days. From this date (the 20th) to the 29th the average boring was about 8 inches a day, the rock being softer although composed of much the same matter as the harder rock, clayey limestone or shale. On the 30th at 29 feet 4 inches from the surface, and 9 feet 4 inches from the overlying rock a bed of shale and slate coal of the thickness of $2\frac{1}{2}$ feet was reached, a specimen of this as taken up by the auger of the machine is marked No. II. Hard rock again occurred and a fortnight was exhausted in penetrating a foot and a half deeper, when another bed of coal and shale like the last but of nine inches only in thickness was reached, earth too had fallen into the bore, and some time was occupied in clearing it out. From this time until the 29th of May when the rising of the river and the constant breaking of the drill and auger warned us to stop the work, not more than half a foot of hard rock which again occurred was bored through.

Thus the whole depth of the bore only amounted to thirty-four feet seven inches, an inconsiderable distance when compared to the extent commonly gone through in search of coal in Europe. Surface coal too is usually of an inferior quality, such as the specimens now sent. But that a true coal field exists at Kotah I think may be inferred from the following reasons.

1st. The strata accompanying the slate coal are those which are found along with deposits of this mineral in other parts of the world, argillaceous limestone and shale, as the specimens sent will abundantly show.

2nd. The fossil plants, of which in the specimens sent the scales of a lepidodendrous plant are most conspicuous, are identical with the fossil plants of the true coal measure, this may be learnt by inspecting them.

Should coal be ever required in this part of India for the purposes of steam, or for smelting the iron ore so profusely scattered through the neighbouring sandstone, it would appear that sufficient data have been now afforded to warrant the sinking of a shaft at kotah whereby a more effectual search can be made than by a boring machine. No difficulty would be met with in procuring

well-diggers for this purpose on the spot, accustomed to wield their own tools and at a low rate of wages.

The importance of finding good serviceable coal on the banks of the Pranheetah, and so close to the main stream of the Godavery is scarcely to be overrated. By means of river steamers of light burden a new avenue of commerce would be opened, and access at a cheap rate would be attained to the most fertile tracts in the Deccan. The navigability of these rivers was shown by Captain Fenwick, late of the Nizam's Service, when in the employ of Messrs. Palmer and Co. of Hyderabad more than a quarter of a century ago, for not only was timber floated down to the mouth of the river, but the cotton of Berar was brought down from Woon, a village on the bank of the Pranheetah seventy-five miles S. E. of Nagpore, to Coringa. In my report on the Chennore Sircar, I shall give in detail various other articles produced in those parts that might be turned to commercial account and profit, if a cheap and free access by means of water carriage to the coast were afforded them.

As the Godavery has never been surveyed with a view to its purposes as a navigable river, I shall give from the information of Captain Fenwick, an account of the obstructions that are met with in its channel. A map, which was furnished to the Supreme Government in June 1841, by the Resident at Hyderabad, Major General Fraser, will indicate the localities where these impediments occur.

From Coringa to Budrachellum, the navigation is perfectly free, except that there is a whirlpool at Papeecondah, not far above Palaverum at the opening of the narrow and tortuous straits of the same name which wind through a range of high hills for more than 12 or 15 miles commencing from the Nizam's Boundary. The river here is generally not more than 300 yards wide. In some places I think even less. The mountains rise almost perpendicularly from the water's edge, and the depth is many fathoms. From Budrachellum to Ellapoka the river is impeded by rocks when it is low, but when half full or more, there is no difficulty in the navigation. The same description applies to the rocks marked at Central Donurgoorum and Albaka ; from the last point the river

although quite free is somewhat shallow, early after the rains. The next obstacle is the two whirlpools at Mooknoor which when the river is full, present a considerable obstacle, but not so when it is moderately full at which time the boatmen, who are very expert, manage to steer between them without danger. The passage between Nulumpully and Mooknoor, is only tedious after the rains as during the freshes the rocks may be sailed over. The last obstacle in the Godavery is just at the junction of the Indarootee. The channel through the rocks, which are there high is very narrow, and pointed ones in it render the passage somewhat dangerous, " some of these" adds Captain Fenwick " I had removed, the nature of the rock being soft slate."

Specimens of Minerals belonging to the Coal Measure to accompany the report.

No. I. and No. II. are referred to and explained in the report.

No. III. Shale and Bituminous shale from Kotah.

No. IV. Prismatic Limestone from the same place.

No. V. Slate Coal.

No. VI. Specimens of Coal with fossil impressions chiefly of lepidodendrous plants to show that the measure is a true Coal.

No. VII. Specimen of Coal found in the river bed (detached).

No. VIII. Specimen of Iron ore (brown clay) found in the vicinity of Kotah.

Report on specimens of Coal, Prismatic Lime Stone and Iron Ore, forwarded with Dr. Walker's Report, by James Dodd, Esq., Assay Master, in charge of Chemical Examiners' Department, Calcutta.

Coal.			Bituminous slate.	
Volatile matter....	29	per cent.	No. 1-41·25-2-26·667.	
Ash..............	29	do.	,, 46·25	,, 66·250.
Carbon..........	42	do.	,, 12·50	,, 6·083.

Prismatic Lime Stone.

Carbonate Lime.... 27-3 per cent.

Iron Ore

Metallic Iron,...... 22-4 do.

Report on specimens of Bituminous Shale transmitted along with Dr. Walker's Report, by Dr. Falconer, A. M. *and* M. D., *Supt. Hon'ble Co.'s Botanical Gardens, Calcutta.*

I have carefully examined the specimens in question six in number, and although they exhibit abundance of black flakes as commonly occurs in bituminous shale, which are probably of vegetable origin, I cannnot detect the presence of any determinable impressions of vegetable fossils. The black flakes, under a careful examination with the microscope, exhibit no marks of structure and appear to be bituminous.

The appearances which seem to have been taken for vegetable fossils and which I presume are those alluded to by Dr. Walker in his Report as "Scales of Lepidodendrous Plants," I have made out to be enamel dersinal plates of an extinct placoid fish co-ordinate with Lepidotus and Dapedius. If Dr. Walker forwarded any well marked vegetable fossils they have not been submitted to me, there are one or two obscure and indistinct impressions probably of organic origin but they are not determinable.

In the list appended to his Report, Dr. Walker mentions No. VI. specimens of coal with fossil impressions chiefly of Lepidodendrous plants to show that the measure is a true "coal," I have observed nothing among those sent, to which this description could accurately apply, nor have seen any samples of coal among them. Should there happen to be any, I should be glad to examine it, on the chance, that some portion of it may exhibit determinable structure. In reference to this point I may mention that I have detected structure on the Burdwan coal, sufficient to determine the plans from which the coal was produced, and which go a long way to prove that the Burdwan coal fields belong to an age and series, perfectly distinct from and more modern than the great English coal measures.

There is no evidence afforded by such of Dr. Walker's specimens as I have seen that the Chennore coal belongs to the same formation, as the English Carboniferous series.

[With reference to the latter part of Dr. Falconer's Report the only specimens approaching coal that accompanied Dr. Walker's letter were forwarded to Dr. Falconer, and he reported upon them as follows.]

I have detected structure in the Chennore coal under the microscope, consisting of glandular dotted vascular tissue referable probably to the natural family of Coniferæ.

Plants of this order are met with in the *Lias* and *Oalite*, as well as in the coal measures, and the Chennore specimens furnish no decisive information as to the formation in which they occur.

[Extract from Dr. Walker's statistical Report on the Northern and Eastern Districts of the Soubah of Hyderabad.]

I have already sent a communication on the coal found in the bed of the Pranheetah, close to its junction with the Godavery, and to this I refer. The subject of rendering the Godavery navigable has lately been discussed, and some interest has been excited in what would appear to be a measure very feasible and very advantageous. Should this scheme ever be carried out, the mineral, conveniently situated as it is, might be turned to profit.

The surface of the coal measure has as yet so to speak been merely scraped, but from the impressions of fossils found on the coal, chiefly Lepidodendrous plants, there can be no doubt of a true coal mine being there in existence.

[Major Jacob, H. C. Astronomer, Madras, placed at the disposal of the Society some Barometer and Thermometer Curves, and supplied a brief notice in explanation of them. The Curves have been accurately lithographed by Dumphy, and will be found at the end of this number, but on a smaller scale than those sent by Major Jacob, to suit the size of the Journal.]

Plates (1) to (8) at the end of this number give the indications of the Barometer and Thermometer for the years 1852—55 as noted at the H. C. Observatory, arranged in curves so as to exhibit the periodical changes. In the case of the Barometer the curves for every month show very conspicuously the course of the daily tides, there being two well marked maxima and minima : the principal maximum occurring at 21*h.* 16*m.* (or $\frac{1}{4}$ past 9 A. M.), while the lowest minimum is seen at about 4 P. M. : with a second rise and fall during the

night; the highest nightly rise being at 10 P. M. and the lowest descent at 15*h*. or 3 A. M.: the daily range being on an average 0·120, and that during the night about half as much. The variations in the times or range between the different months is very trifling, but the mean value for each month shows considerable alterations; the mercury standing highest on the average in January, falling gradually until June, and rising again from July to December, the rise being usually, but not always, most rapid from October to November. The same general course is also visible, though subject to great fluctuation, in the curve of daily means at the foot of each Barometer Plate, where are shown the successive changes in the mean height of the mercury from day to day. In most of the years there will be seen one or more considerable depressions about the beginning of November, indicating the effect of the storms which so frequently occur about that time.

The Thermometer curves have rather a peculiar form; that portion which belongs to the day, viz. from 18*h*. to 6*h*., having nearly a parabolic shape, while the night portion scarcely differs from a straight line, showing a nearly uniform descent from sunset to sunrise, the change from the night to the day being much more abrupt than the converse. The coldest time of the 24 hours appears to precede that of sunrise by a few minutes; the hottest time is about 1*h*. 10*m*. P. M., but varies in the different months from 0*h*. 30*m*. to 2*h*. June is on the whole the hottest month but is nearly equalled and in one year surpassed by May. The coldest month is January, but December and February differ but little from it. The range of temperature is seen to be much greater in the hot than in the cold season, the least occurring in November. The mean daily range amounts to 12°.

New species of Silk Worm.

"THE AGRI-HORTICULTURAL SOCIETY OF INDIA has reported most favourably on a new variety of silk, brought into notice by Capt. HUTTON, of the invalids, a resident of Landour. The worm which produces it *(Bombyx Huttoni)* spins in all weathers, whereas the common silk-worm is apt to be thrown off work by a passing

cloud. It is thought that the new worm may prove commercially important, and Government is solicited to institute experiments regarding its productive powers. In connection with silk it was announced at the late meeting of the Society, that the new plan of manufacturing silk directly from the bark of the mulberry tree is rapidly gaining ground. Signor LOTTERI, the inventor, announces that four companies have been started in Europe for carrying out the system, one of which has already paid him down 25,000*l.* for the privilege."—*Allen's Induan Mail,* 30*th Jan.* 1857.

NOTICES OF BOOKS.

Oriental Literature.

The Poems of the Hudsailis, edited in the Arabic from an original MS. in the University of Leyden and translated with annotations by J. G. L. KOSEGARTEN ; vol. I. containing the Arabic text, London, 1854, 4to.

This work is now in course of publication by the Council of the Oriental Translation Fund. The first volume contains only the Arabic text. M. KOSEGARTEN purposes to give a complete translation in the second and the remainder of the text in the third.

This collection of poetical compositions or Dewans contains the National poems of a tribe of Bedouins—the *Hudsailis* or *Hodeilites* and belongs to the same class of compositions before the Æra of Mohammad as the *Moallakat,* the *Hamasa* of BOHTORI and the *Kitab-al-Aghani* of which latter work Mr. KOSEGARTEN has also commenced the publication. The MS. which is a unique copy, in the Library at Leyden, is incomplete, the 2nd volume only being in existence but it contains the commentary of ASSUKARI, the compiler of the work.

In connection with the literature of this epoch are the *Ansab* or geneological tables of the Arab races published by M. WASTENFELD at Gottingen from the writings of MOHAMMAD BIN AL HASAN IBN DOREID, a poet and philologist of the 3rd century of the Hijri,

Geneologische Tabellen der Arabeschen Stæmme und Familien von Dr. FERD. WASTENFELD—Gottingen 1852, Fol.

Register zu den genealogischen Tabellen with historical and geographical notices, 1853.

Handbuch Geneologisch etymologisches von ABUBEKR MOHAMMAD BIN AL HASAN IBN DOREID *heransgegeben von* FERD. WASTENFELD—Gottingen 1854, 8vo.

The indefatigable M. VON HAMMER continues the publication of his great work on Arabic Literature *(Literatur geschichte der Araber)* of which the 5th vol. containing 1,115 pages appeared in 1854 and the 6th extending to 1,169 pages in 1855.

The Library of the Society possesses a copy of this admirable work presented by the munificence of M. VON HAMMER himself. Each vol. commences with a general view of the literature of the epoch of which it treats, followed by biographical sketches of the writers arranged either according to the class of society to which they belonged or according to the subject of their works; followed by translations of some of the most remarkable poems.

The six volumes already published contain notices of more than 700 authors and afford a striking example of the patient and laborious habits of study and research so remarkably characteristic of the savans of Germany.

The 2nd and 3rd volumes of the Travels of Ibn Batuta—the text and translations by MM. C. DEFREMERY and Dr. B. R. SANGUINETTI, have been published at the Imprimerie Imperiale, Paris, 1854 and 1855.

M. RENAN is occupied with a valuable philological work on the Semitic languages, the first volume of which appeared in 1855 and received the prize of the Institute.

It is entitled *Histoire Generale et Systeme comparè des langues Semitiques,* par ERNEST RENAN, Paris, 1855, 8vo.

The fourth volume of the translation of the *Shahnameh of* FIRDAUSI, by M. JULES MOHL, Secretary of the Asiatic Society of Paris, appeared in 1855.

The third volume of the *Rig Veda Sanhita* with the commentary of SAYANA CHARYA, by M. MAX MULLER, has been published and copies are on their way to India.

Another translation of the *Hitopadesa* has appeared at Paris by M. LANCEREAU. It is very neatly got up in 12mo. and is enriched with interesting notes tracing the origin and history of the several fables and tales.

The first complete translation of the Persian version of the same work, the *Anvari Soheili* of HOSEYN VAZ AL CASHAFI, by Professor EASTWICK, was published by Austin of Hertford in 1854.

From the same Press has likewise issued a new edition of the text of the *Bhagavat Gita* with a translation by J. COCKBURN THOMPSON, 1855.

The VII. No. of the Journal of the Asiatic Society of Bengal for 1856, which has lately been received, is occupied by an index of the matter contained in the previous volumes from I. to XXIII. and of volumes XIX. and XX. of the Asiatic Researches. It is followed by a supplement repairing omissions in the first and by three special indices—1. of the Numismatic matter contained in the Journal; 2. of translations of ancient inscriptions, reprinted from the Journal of the Royal Asiatic Society, vol. VI. and continued to the end of 1854; and 3, a geological and mineralogical index to the Gleanings of Science, Asiatic Researches and the Journal of the Society.

A Comparative Grammar of the Dravidian, or South Indian Family of Languages, by the Rev. R. CALDWELL, London, 8vo. has just been received.

Mr. Caldwell has labored for the last seventeen years as a Missionary in the South of India. During a recent visit to England he completed a Comparative Grammar of the Languages of Southern India, the family of which he divides into nine principal branches, viz. Tamil, Teloogoo, Canarese, Malayâlum, Tolu, Toda, Kota, Gond, and Khond. He has discussed in detail the connexion these dialects have with each other, as well as that of the whole family with the families of other languages. He is opposed to Mr. Hodgson's theory

in regard to the identity of the languages of Southern India with the dialects of the Himalaya and Bootan, being more inclined to support the views of Mr. Max Muller on the affiliation existing between the Dravidian, and what is now styled the Scythian group of languages.

We hope to give a review of this in our next Number.

A Dictionary, Sanscrit and English, extended and improved from the second edition of the Dictionary of Professor H. H. Wilson, together with a supplement, grammatical appendices and an index serving as an English-Sanscrit Dictionary, by Theodor Goldstücker, Berlin, 1856, large 4to.; part 1, (80 pages.)

This is the commencement of the publication of the long expected 3rd edition of Professor Wilson's dictionary.

The preparation of this new edition has been undertaken by Mr. Goldstücker alone. It contains considerable additions more particularly of those vêdu terms which Professor Wilson systematically excluded.

Mr. Goldstücker promises to insert in a supplement those words whose meaning he has not been able satisfactorily to explain as well as all new words he may meet with in the course of publication. The work will appear in parts, each part to contain 80 pages —price 87 fr. 50 centimes.

We are glad to have to announce the publication of a work in connection with our own Presidency, viz. a new edition of DR. BAIKIE's *Book on the Neilgherries.* It is thus noticed by the *Hurkaru.*

" Mr. W. H. Smoult has got up with great trouble and expense an edition of an account by R. Baikie, Esq., M. D., of *the Neilgherries, their topography, climate, soil and productions, and of the effects of the climate on the European constitution.* The subject matter of the work is of great interest to very many persons in this community, but the point which we are most disposed to dwell upon is the admirable style in which Mr. Smoult has contrived to get the work illustrated by an artist of the name of Fraser, a stranger we believe amongst us and who is about to try his fortune in another land, unless perhaps the local Government has the good sense to secure

so able a hand to its own service. The large panoramic view of Ootacamund is a picture that well deserves a handsome frame and is worth the price of the book itself. Then there is a capital frontispiece with a view of Sispara on the Neilgherries drawn from nature by Captain Francis and transferred to stone by Mr. Fraser, and there are four other separate sketches which with the large panoramic view of Ootacamund are enclosed in a tin case. The illustrations are all tinted lithographs and all exhibit an artist's taste and skill. Indeed such artistical productions in the way of book embellishments have never been published before in this country. In a land like this where health and even life itself are so precarious, every information regarding the climate of particular localities ought to be received with eagerness not only by the community but by a "paternal government." The Government of Madras, we hear, has subscribed largely to the work before us, by way of encouraging all attempts on the part of individuals to make the community acquainted with the character of the country and its resources. Such a sanatarium as the Neilgherries furnish us is a blessing that cannot be too highly appreciated. Many a valuable servant may be saved to the State, by having so near us a climate so admirably adapted to the restoration of individuals. Dr. A. Grant, who was the personal surgeon of the Marquis of Dalhousie and accompanied his Lordship to the Neilgherries in 1855 remarks that "it is surprising the advantages of the Blue Mountains should have been so long overlooked, in a country where European health is so precarious and the necessity of a change to a cool climate is so frequently and urgently called for. In Bengal they have scarcely attracted any attention, otherwise, how many invalids might have been saved a trip to Australia, or the Cape or even to England." Dr. Grant recommends that in Bronchitis, or incipient consumption, or when the liver is affected the patient should first go to Coonoor, "a pleasant, retired, and pretty summer residence," well sheltered and easily accessible, and when he has gained strength he should go, he says, to Ootacamund, the air of which is more bracing. In a very few days an invalid could pass comfortably from Calcutta to Ootacamund. The climate of the Neilgherries is delightful and the scenery is singularly varied and picturesque, as may be seen from the

accurate and truly artistical sketches which accompany the work before us.

" We learn from Mr. Smoult's excellent explanatory introduction that the late Bishop James, in a letter to the Right Hon'ble S. R. Lushington expressed himself perfectly charmed with the hills of Ootacamund. " I have been racking my memory," he wrote, "for some place to compare them with ; the closest resemblance I can find is " Malvern" at the fairest season : but the extent and bold variety give these a decided superiority. I have a fuller sense of the enjoyment to be derived from air and exercise than I remember to have ever experienced at any time or at any place."

" Mr. Smoult's own share of the work is carefully and ably executed. He has brought out a very valuable publication. It does him great credit in every way. If Mr. Smoult should be a pecuniary loser by this costly publication he will at all events have the pleasant consciousness of having done a real service to his countrymen in India by calling their attention to the lovely and health-inspiring locality of the Blue Mountains. This book may save many a valuable life by its suggestions and the interesting information which it will circulate through a community in which individuals are so often reduced to the alternative of an immediate change of climate or a preparation for their final home."

Natural History.

DECANDOLLE'S PRODROMUS. Vol. XIV. Part. I. has lately reached us. It contains the large order *Polygonaceæ,* by C. F. MEISNER, excepting the Sub-order *Eriogoneæ,* which are from the pen of the laborious Mr. G. BENTHAM : *Myristicaceæ,* by the Author. *Proteaceæ,* by MEISNER, and *Penæaceæ,* by ALPH : DECANDOLLE. The Volume is a worthy addition to its invaluable predecessors.

Plantæ Indiæ Batavæ Orientales.

A work under this title is now in course of publication by the

Dutch Government under the especial patronage of the King of Holland. It is edited by Professor DE VRIESE. The first part which has only as yet appeared contains a full account of the plants found in the principal islands of the Eastern Archipelago—Java, Celebes, Amboina, Ternate, &c. from the MS.S. of the late Professor C. A. C. REINWARDT, between the years 1815 & 1822 edited by Dr. W. H. DE VRIESE, Professor of Botany in the University of Leyden. The technical descriptions are given in Latin and are illustrated by characteristic lithographed figures.

The work will be published in 4to. with 40 plates ; three numbers have appeared in 1856, four more are to be given in the current year and the rest in 1858.

DR. REINWARDT died in 1854 without having given to the world any consecutive work on the rich and important collections he had made in the Dutch Colonies. His papers and drawings were presented to the Government and the task of editing them was entrusted to Professor Vriese.

" I purpose" says the Professor, " first to publish in this work, " the plants that DR. REINWARDT discovered during his travels in " the Indies and to elucidate such portions of their history as have " not already been investigated by the researches of other botanists. " When it is remembered that Messrs. BENNETT and R. BROWN " have only lately published the plants which DR. HORSFIELD " discovered in the island of Java at the commencement of the century, it need not be matter of surprise that the discoveries of " REINWARDT in the other islands subsequent to 1815 should still " be worthy of publication. We doubt not that the labor we now " propose to ourselves of making known the botanical researches " of DR. REINWARDT will bring to light a great number of new " plants and contribute to give a better idea of the geographical distribution of plants in the Indian Archipelago, of which so little is " yet known."

One of the plates which have already appeared represents a plant which would form a most desirable addition to our gardens. The *Dichrcfrichum Ternateum* found in the forests near the summit of the

Volcano of Ternate. It is a prostrate plant creeping on the ground but is conspicuous for its large, downy, cordate leaves and its bunches of scarlet tubular flowers from one to two inches long.

It appears to be allied to *Streptocarpus* with the habit of *Œschynanthus*.

At the meeting of the Botanical Society of Edinburgh, on the 12th June last, a paper was read by Lt.-Col. MADDEN on "*the elucidation of plants mentioned in* Dr. FRANCIS HAMILTON'S *account of the Kingdom of Nepal.*

At the following meeting on the 10th July 1856, Professor Balfour on taking the chair announced that since the last meeting Col. Madden had died suddenly from rupture of the aorta.

"We all, I am sure (he said), deeply deplore the loss of one who took a warm interest in our proceedings, and with whom we have had much pleasant intercourse. For my own part I cannot easily give expression to the sad feelings with which I contemplate the bereavement. He had been a constant visitor at the garden during the summer while engaged in preparing his elaborate paper on the Indian Plants in Dr. Buchanan Hamilton's herbarium; and I had looked forward to the pleasure of spending many a happy day with him in the prosecution of Botanical science. His amiable deportment and gentlemanly manner endeared him to all of us, and we all rejoiced to see one who had spent a large portion of his life in the active service of the East India Company, now devoting his time and leisure to the prosecution of science. During his residence in India he was a careful observer, and made many interesting remarks on the flora of the country. He sent home the seeds of many valuable plants which have flowered in Glasnevin and in other gardens. When he came to settle in Edinburgh he joined the Royal and Botanical Societies, in both of which he became a very active member. He was elected a councillor of the Royal Society, and took a marked interest in its proceedings, he particularly took charge of the Scientific additions, which it was agreed to make to its library. To the transactions of the Botanical society he contributed an excellent paper on the occurrence of

Palms and Bamboos high on the Himalaya, and it is to be hoped that the paper which was read from him at our last meeting will be in such a state as to allow of its publication. Most sincerely, I am sure, do the Society condole with his afflicted widow. Such events call on us to be ready, seeing we know not what a day may bring forth."

At the same meeting a paper was read entitled, *A brief account of the general Botanical features of a Hill District in Western India,* with the results of a series of observations in connection with vegetable climatology. By JOHN KENNETT WILSON, Bombay.

PROCEEDINGS.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday Evening, January* 8, 1857.

The chair was taken at ½ past 6 by W. U. ARBUTHNOT, ESQ.

The Secretary laid the usual statements before the Meeting and the following papers were selected for the evening.

Read an interesting account from Major Jacob, the Honorable Company's Astronomer, explaining the different indications of the Barometrical and Thermometrical Curves, for the years 1852-53, 54 and 55; the Plates having been previously forwarded by him to the Society.

In regard to the Barometer the Curves for every month show very conspicuously the course of the daily tides, there being two well marked Maxima and Minima the principal Maximum occurring at ½ past 9 A. M., and the lowest Minimum at 4 P. M. The Mercury stands highest on the average in January, falling gradually till June, and rising again towards December. The Rise is usually most rapid from October to November, about which time considerable depressions are also observable indicating the effect of storms which not unfrequently sweep over this coast at that time of the year.

The Thermometer Curves, show the coldest time of the 24 hours to be a few minutes before sunrise, and the hottest time to be 1h. 10m. P. M. but varying in different months from 0h. 30m. to 2h. June on the whole is the hottest month and January the coldest. The range of Temperature is greater in the hot than in the cold season, the least occurring in November. The mean daily range amounts to 12°.

Resolved that the thanks of the Meeting be voted to Major Jacob, and that his paper be set aside for publication.

Read letter from Secretary to Government, dated 23rd Dec. 1856 forwarding Dr. Walker's Report on Coal boring at Kotah, a village about 10 or 12 miles from the junction of the Wurdah river with the Godavery.

In 1841 Dr. Walker submitted to the Asiatic Society of Bengal an account of some minerals found in the bed of the Godavery, of the nature of Slate Coal, with a few remarks on the Geological features of the place at which they were discovered. The account will be found published at page 341, vol. 10 of the Journal of the Asiatic Society of Bengal.

In consequence of the indications set forth in that paper a boring operation was determined on, and entrusted to Dr. Walker's superintendence.

The Rods, Drills, and Augers of the Boring-Machine were made up at Bolarum—about 30 feet was pierced on the first day; afterwards, falling in with Argillaceous Limestone it took 9 days to get through a foot. At the depth of 29 feet a bed of Shale and Slate Coal was met with. The whole depth pierced was only 34 feet 7 inches.

Dr. Walker infers that a Coal field may be found at Kotah for the following reasons.

1st. The strata accompanying the slate Coal are those which are found along with deposits of this mineral in other parts of the world.

2d. The fossil plants apparent are identical with the fossil plants of the true Coal measure.

The report concludes with an account of the obstructions to navigation in the Channel of the Godavery.

Read also letters from Mr. Dodd in charge of Chemical Examiner's Department, and from Dr. Falconer, Superintendent of the Botanical Garden, Calcutta, upon the mineral specimens forwarded by Dr. Walker.

The thanks of the Meeting were presented to the Contributors of the above Papers. Some time has elapsed since Dr. Walker's experiment, but Madras having now its Railway and Mineral Viewer, and the Committee being aware of the great importance of a Country like India being able to supply itself with Coal and Iron in the same way as England is favored with the former, thought it advisable to put on record in the Journal an experiment like Dr. Walker's, and it was resolved accordingly to request the Committee of Papers to arrange for the publication of his Report.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday Evening, Feb.* 12, 1857.

The Hon'ble W. ELLIOT, in the CHAIR.

The Secretary read a letter, from Dr. Jameson, Superintendent of the Botanical Garden at Saharunpoor, to Mr. Elliot, giving an account of the Tea plantations in the Himalayas.

The encouragement given to the cultivation of Tea in the last 2 years bids fair to render Tea a staple article of produce in the N. W. Provinces. Last year the quantity turned out was 40,000 lbs. this year that amount will be doubled. It is now in great demand at Almorah and Deyrah, the best kinds realizing from 3 Rs. to 4 Rs. 8 As. per poun , and this not for small quantities, the amount disposed of having been 20,000 lbs.

A great proportion of the second class Teas was purchased by natives for the purpose of bartering with the Bhotiahs in the interior of the Himalayas and Thibet in exchange for Borax and other

products of the mountain region. Up to this time the Mountain races have been in the habit of consuming the brick Teas of China.

It is certainly a remarkable fact that an integral part of the Chinese Empire is receiving its supplies of Tea from India, and Dr. Jameson is sanguine that if aided by good roads the trade with the Bhotiahs will soon become an important one, and that the Indian Teas will be sold at rates so cheap as to drive the Chinese article out of the market in these regions.

Extracts of a letter from Professor Oldham to Mr. Brooke Cunliffe, were also read acknowledging the receipt of certain fossil remains from the cretaceous beds at Utatur and Verdachellam for the Museum of Economic Geology. Putting aside the Cephelopoda, Mr. Oldham observes, the specimens from the two localities indicate only a little difference in the depth of water where the deposits were formed; but the presence of these chambered shells points to a series of beds somewhat higher in Geological sequence. The great prevalence of *ammonites* of the section of *Ligati* as compared with the Verdachellam group is of this nature.

Mr. Oldham also sent copies of the prospectus of the new organization of the Geological Museum, one of which Mr. Cunliffe presented to the Society.

It is proposed to print this on the fly leaf of the Journal, and it is hoped that the Members of the Society will exert themselves to procure contributions to the collection. It is only by grouping together the geological facts derived from a comparison of fossil remains from all parts of India that a correct idea can be formed of the geological structure and conditions of this vast country. And the eminent qualifications of the officers attached to the geological survey afford the best guarantee that full justice will be done to such contributions.

Mr. Oldham adds that he had recently obtained a small collection of fossils from the limestone to the west of Mhow and Indore near the Nerbudda Valley which appear to be nearly of the same geological age as those from Utatur, with considerable variety however, as was to be expected from the difference of latitude.

It was also stated to the Meeting that fossil remains of a large vertebrate animal probably a gigantic saurian have recently been discovered at Utatur. Mr. Adolphe Schlagentweit, found a large bone, apparently the condyle of a femur, and a portion of what is stated to be a large tooth sent to Dr. Hunter by Captain Ryves will be shown at the forthcoming Exhibition.

The Annual General Meeting of the Society was fixed for the 26th Instant.

MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday Evening, February* 26, 1857.

SIR C. RAWLINSON, KT., PRESIDENT, in the CHAIR.

This was the Annual General Meeting of the Members of the Society.

The President, on opening the Meeting brought to notice an error that had crept into the Society's monthly Reports, of publishing the Proceedings of the Managing Committee of the Madras Literary Society as the Proceedings of the Madras Literary Society, none of the Members of which, save the Managing Committee, appear to have had an opportunity of attending, and it was resolved accordingly that endeavours should be made to give all Members the opportunity of attending any Literary or Scientific Meeting which the Managing Committee might be able to arrange.

The Secretary read to the Meeting the usual Report and Statement exhibiting the state of the Society's Funds up to the end of the past year.

To

The Members of the Madras Literary Society
and Auxiliary of the Royal Asiatic Society.

GENTLEMEN,

The Managing Committee of the Society have the honor to lay before you the accompanying Statement of the accounts of the Society for the past year, exhibiting a balance in favor of the Society on the 31st December last, of Rupees 750-14-0.

The balance at the end of 1855, was Rupees 469-13-4.

The Committee hope this will be deemed satisfactory.

It may not be out of place here to add that the Statement rendered at our last Meeting on the 12th instant, exhibits a still more favorable view of the Society's Funds, showing a credit balance of Rupees 1,052-8-8.

The Committee have further to announce that, with the view of upholding the Literary and Scientific character of the Society, the publication of their Journal has been resumed, and from the present number of Subscribers they have every reason to hope that the issue of this Periodical will tend to the advantage of the Institution, and prove attractive to the Community.—255 copies out of 350 have already been disposed of.

In conclusion the Committee desire to state that the number of Subscribers to the Library at the end of the past year stood as follows:

First Class	38
Second Class	34
Third Class	16

For the Managing Committee.

(Signed) J. W. BREEKS, *Secretary.*

Resolved, on the motion of Mr. R. Burgass, seconded by Mr. H. Fortey, that the Report be received and printed in the Journal.

Resolved, on the motion of Mr. R. Burgass, seconded by Major W. J. Wilson, that the Managing Committee use their best endeavours to obtain books on more advantageous terms, now that the late changes in the Book Trade hold out such a prospect to Purchasers.

Resolved, on the motion of the Chairman, seconded by Mr. R. Burgass, that the accounts be passed as satisfactory, and that the thanks of the Meeting be presented to the Managing Committee of the past year for their exertions in behalf of the Society, and that they be re-elected into a Managing Committee for the present year.

Resolved, on the motion of Mr. W. U. Arbuthnot, seconded by the Honorable Walter Elliot, that Mr. R. Burgass be invited

to become a Member of the Managing Committee, to complete the number as laid down in Rule VI. of the Society's Regulations.

The following Gentlemen were elected as the Managing Committee for the current year.

MANAGING COMMITTEE.

Major W. J. Wilson,	Mr. W. U. Arbuthnot,
Mr. T. Pycroft,	Major E. Lawford,
Colonel F. A. Reid, C. B.	Mr. H. F. C. Cleghorn, M. D.
Lieut. Col. T. T. Pears, C. B.	Mr. A. J. Arbuthnot,
Lieut. Col. F. C. Cotton,	Mr. R. Burgass,
Mr. G. H. Ellis,	Mr. J. W. Breeks, *Secretary.*

The thanks of the Meeting were voted to the Chairman, and the Meeting closed.

The Managing Committee of the MADRAS LITERARY SOCIETY *and Auxiliary of the Royal Asiatic Society, Thursday Evening, March* 12, 1857.

On the motion of Mr. W. Arbuthnot, seconded by Colonel Cotton, the Hon'ble W. Elliot, was elected Chairman of the Committee for the current year.

The Secretary laid before the Meeting the usual Monthly Statement of the Society's Funds, and brought to the notice of the Committee the urgent necessity which existed for a complete Catalogue of the Society's Books by embodying the Supplemental Catalogues for 1852-53 and 55 with the old Catalogue, and classifying each work under its appropriate head.

Resolved that the state of the Society's Funds is satisfactory, and that a new Catalogue of the Society's books be printed as soon as possible, containing every work received into the Library up to January 1857.

Extracts of a letter from Mr. Thwaites, Superintendent of the Royal Botanic Garden of Paradenia in Ceylon to Dr. Cleghorn were read, in which he expressed his readiness to permit the descrip-

tions of the new Genera of Plants of Ceylon, published by him in the Kew Miscellany, to re-appear in the Society's Journal.

The intimate connection of the Flora of India with that of Ceylon invests the details of such discoveries with peculiar interest for the Botanists of this part of the country and the Committee at once resolved to avail themselves with thanks of Mr. Thwaites' liberal permission. The Sub Committee of Papers were accordingly directed to make a selection of some of these New Genera for publication in future Numbers of the Journal.

Dried specimens of several of these, especially of such as are likely to prove useful in the Arts, have been forwarded by Mr. Thwaites to the present Exhibition.

Some of the early Proof Plates of Dr. McPherson's Antiquities of Kertch were laid on the table and attracted much admiration. They represented Vases, Statuettes, Bas Reliefs in Terra Cotta, Glass and Ivory, of Greek and Etruscan Types, Fibulœ and Gold ornaments, bearing a remarkable resemblance to thos e found in the Tumuli and Mounds in Britain and which Dr. McPherson supposes may have belonged to the Varangian Guards of the Byzantine Emperors, &c.

The Plates are executed in the best style of Chromolithography by a young and rising Artist named Kell, and though unfinished give promise of great beauty and elegance when completed.

The Committee acknowledge with thanks the receipt of the following papers.

1. Observations on the Graphite or Plumbago of Kumaon and Travancore by J. Forbes Royle, M. D. with an Extract from a letter from the Resident of Travancore and Cochin dated 9th February 1857, *from the Chief Secretary.*

This Mineral was formerly found in its most pure state in Borrowdale in Cumberland, which indeed was the only Mine which produced Lead of that fine quality requisite for the manufacture of Drawing Pencils.

The Cumberland Mines have been wrought since Elizabeth's time; pure Cumberland lead costing as much as from 30 to 40

shillings a pound. The lead is not found in veins but in detached pieces, so that the supply is occasionally irregular and the search for it laborious and often fruitless.

Inferior descriptions of lead come from Spain and Ceylon, and are used in the manufacture of crucibles and of the inferior sort of Pencils and in polishing Cast Iron.

At present Mr. Royle says, finely powdered Graphite can, by an extreme degree of pressure, be rendered nearly as compact as the best natural Graphite, or we should be without any more good drawing Pencils.

The great Manufacturers of Pencils in England reported the Kumaon and Travancore specimens as quite useless for the manufacture of black lead pencils, observing that they could not use the specimens in the state in which they had been sent without damaging their machinery, at the same time they could not conceive why purer specimens should not be found in the same locality.

In regard to the objections made to the specimens forwarded, General Cullen, the Resident of Travancore, remarks that one motive of their selection was to exhibit the matrix or Laterite rock in which they were found.

2. Reports V, VI, VII, and IX of the proceedings of the Officers engaged in the Magnetic Survey of India, *from the Chief Secretary.*

3. Memoirs of the Geological Survey of India, Vol. I. Part 1. *from T. Oldham, A. M., F. R. S., F. G. S. &c. Superintendent of Geological Survey of India.*

This is the first of a series of Memoirs published by order of the Right Honorable the Governor General of India in Council. The subject of the present Notice contains a highly interesting account of the Talcheer Coal Fields, situated in the Tributary Mahal of Cuttack, there is also a short notice of the Iron Ore procurable in the same locality.

Appended to this Memoir will be found accounts of the auriferous deposits of Assam and the vicinity of Shuè-gween in the Pro-

vince of Martaban. The gold discovered in both localities is of considerable purity, the latter Mr. Oldham considers fully equal in value to the average quality of Australian gold.

With the Book Mr. Oldham forwarded a letter to the Secretary and a notice setting forth the object of the Geological Museum now in progress in Calcutta of which he expressed a hope that the Society would obligingly promote the welfare, and sanction an interchange of publications.

Resolved that the notice be printed in the forthcoming number of the Journal, and that a letter be addressed to Mr. Oldham intimating the pleasure it will give the Society to effect an interchange of publications as desired by him.

The Meeting separated a little before 8 o'clock.

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

DAILY MEANS.

December 1856.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Thermometers. Means. Wet	Thermometers. Max.	Thermometers. Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Inches	
1	29·960	76 2	70·1	82·0	72·3	N by E	0·010	Cloudy
2	·949	76·0	69·7	83·2	72·1	N by E	....	do
3	·972	75·8	68·8	83·0	71·5	N N W	....	do
4	·959	76 0	70·9	81 6	73·6	N N W	....	do
5	·961	74·2	70·0	82 7	72·0	N by W	·303	do
6				79·3	70·7	N by W	1·240	
7	·898	70 6	69·1	76 6	68·8	N by W	3·080	Overcast
8	·812	75 1	73·1	79·8	71·0	N E by E	1·367	do
9	·884	75·0	73·2	82·2	73·1	S E	1·752	do
10	·961	76·0	74·0	82·0	75·0	N E	·175	do
11	·977	77·0	74·2	82 8	74·3	N E	·610	Cloudy
12	·992	77·5	74·2	82·8	76·2	N E by N	·095	do
13				82 6	74·6	N E by N	·815	
14	·988	76·6	73·7	82·0	75·1	N by W	·058	Overcast
15	·969	76 4	73·1	82 3	73·6	N N E	....	Hazy
16	·973	76·2	71·9	81.9	71·8	N N E	....	do
17	·976	75·4	70 6	81·8	71·5	N N E	...	do
18	·098	74·3	69·3	81·3	69·4	N E	....	do
19	30·039	74·8	68·9	81·5	70 1	N N E	....	do
20				80·4	69·3	N by E	....	
21	·032	75 4	69 1	81·8	72·8	N E	008	do
22	·038	77·0	68·6	82 5	72·8	N E by N	....	do
23	·013	75·6	69·9	81 3	71·3	N by E	....	do
24	29 988	75 7	69·0	81 2	72 6	N by E	....	do
25	·088	74·2	69 7	80 6	71 0	N	....	do
26	30·038	75·4	69·4	83 0	70·7	N	....	do
27				83.2	72·1	N by E	....	
28	29 996	74·8	69·3	82·0	70·2	N N W	....	do
29	·969	76·2	69·8	82·8	71·0	N	....	Clear
30	·957	76·7	72·6	83·8	73 5	N	....	Hazy
31	.957	77·6	72 8	83·6	76·0	N E by E	....	do
Means	·972	75 6	70 9	81 9	72 3		9 713 Sum	

January 1857.

Date.	Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Thermometers. Means. Wet	Thermometers. Max.	Thermometers. Min.	Wind.	Rain.	Remarks.
	Inches	°	°	°	°		Inches	
1	30·020	77·1	71·6	82·7	75·2	N E	....	Cloudy
2	·079	75 3	69·9	83·6	70·7	N E	....	Hazy
3				83·7	71·3	E N E	....	
4	·086	75·9	71·4	83·8	72 3	E N E	....	do
5	·092	76·1	71·2	82·1	72·4	E N E	....	Cloudy
6	·100	75·4	69·1	81·8	69 3	E N E	....	Clear
7	·065	75·8	69·1	83·0	71·2	N E	....	Hazy
8	·057	75 2	69·9	82·8	71·5	N E	....	do
9	·051	76 5	70·8	82·8	72·1	N E	...	do
10				83·4	75·5	N E	....	
11	·059	77 3	70 7	84 0	75 6	E N E	....	do
12	·081	75·9	68·7	83·3	69·4	N E	....	do
13	·069	76·7	68·8	82·7	75 1	N E by E	....	do
14	·037	74·8	68·7	82·5	70·5	N E	0·003	do
15	·002	75·1	70·6	81·6	72 8	N	....	Cloudy
16	·020	74·6	69 5	81·2	69·7	N E	·320	Hazy
17				82 5	67·3	N E by E	....	
18	·006	73·2	67·9	81 6	68·0	N by E	....	Clear
19	29·981	74·3	68·6	81·7	68·9	N E	....	Hazy
20	·986	73·7	67·2	81·2	67·4	N E	...	do
21	·980	73·3	66·5	80·7	66 2	N E	....	Clear
22	·974	72·6	65·6	80·7	66 4	N N E	....	Hazy
23	·968	71 5	65·0	80·3	65·4	N N E	....	Clear
24				81·0	60·7	N N E	....	
25	·954	74 0	68·2	82·7	70 2	N N E	....	Hazy
26	·927	76 6	70·6	82·6	74·4	N E	....	Cloudy
27	·905	77·0	71·8	83·6	75·0	N E	....	do
28	·919	76·5	71.9	85·2	72 5	N E	....	do
29	·927	76·8	72·5	84·5	72 1	N by W	....	Hazy
30	·923	76·5	72·7	84·7	72·0	E N E	....	Clear
31				84·0	71·8			
Means	30 010	75·3	69 6	82·6	70 9		·323 Sun	

February 1857.

Barometer reduced to 32° Faht.	Thermometers. Means. Dry	Thermometers. Means. Wet	Thermometers. Max.	Thermometers. Min.	Wind.	Rain.	Remarks.	Date.
Inches	°	°	°	°		Inches		
29 937	75·6	71·9	83·7	69·3	E	....	Clear	1
·950	75·4	71·5	85·0	70 1	S E	....	do	2
·953	74·1	70·3	83·5	67·5	S E	....	do	3
·919	72·8	68·4	83·0	66·4	S E	....	do	4
·965	72·9	68·3	83 3	67·3	?	....	Cloudy	5
·981	75·1	69 4	83·7	69.4	E N E	....	Hazy	6
			84 1	69 7	?	....		7
·945	74·8	70·0	83 9	69·8	E	....	Clear	8
·966	74·6	69·8	84·0	69·4	N E	....	do	9
·983	75·6	70·8	84·2	70·2	N N E	....	do	10
·957	75·3	71·7	84 9	69·8	E by N	....	do	11
·927	76·6	72·2	86·3	71·5	?	....	do	12
·030	77·1	72·6	86·7	71·2	S S E	....	do	13
			86 0	70·6	S S E	...		14
·916	76·7	72 3	86·1	71·7	S S E	....	do	15
·940	77·0	71·8	85 8	71·7	S E	...	do	16
·972	76·2	69·3	84·6	69 2	N E by N	...	do	17
·995	76·2	69 6	84 2	69 9	N E by E	....	Hazy	18
·978	74·4	69·0	83·9	67 2	N E	....	Clear	19
·915	75.0	69·8	87·4	67·3	?	....	do	20
			87·8	66·6	?	....		21
·884	75·0	69 5	86·4	67·8	S E by S	....	do	22
·914	74·4	68·8	85 9	66 0	S E	....	do	23
·914	74·7	68 0	90·0	66·4	S S W	....	do	24
·820	75·9	68·1	91·7	66·1	"	....	do	25
·820	76·9	71·9	87·3	71·4	S	....	do	26
·841	76·4	71·9	87·6	70·2	S E	....	do	27
			87·3	70.1	S E			28
								29
								30
								31
29·932	75·4	70·8	85·7	69· 1		0		

? This mark signifies that no Means can be taken owing to the variable state of the Wind.

Extract from Meteorological Observations kept at the Madras Magnetic Observatory.

HOURLY MEANS.

Gottingen Mean Time....		Noon.	1	2	3	4	5	6	7	8	9*	10	11*
Madras Mean Time......		h. m. 4 41 P. M.	h. m. 5 41	h. m. 6 41	h. m. 7 41	h. m. 8 41	h. m. 9 41	h. m. 10 41	h. m. 11 41	h. m. 12 41	h. m. 13 41	h. m. 14 41	h. m. 15 41
		Inches	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Barometer at 30° Faht...	Dec. 1856	29·932	29·946	29·970	29·993	30 005	30·009	30·001	29 992	29·977	29 958	29 943	29 937
	Jan. 1857.	·962	·974	·991	30.014	·034	·040	·034	30 023	30 010	·997	·980	·970
	Feb. do	·879	·890	·909	29 933	29 955	29·966	29 967	29 958	29 915	·928	·911	·991
		°	°	°	°	°	°	°	°	°	°	°	°
Dry Thermometer......	Dec. 1856.	77·3	76·2	75·5	75·1	75 0	74·7	74·3	74 2	73·8	73·4	73·1	73·0
	Jan. 1857.	78·0	76 8	75·8	75·4	75·1	74 8	71·3	74·0	73 0	72 4	71·9	71 3
	Feb. do.	80·7	78·8	76 9	75·7	74·6	73 5	72·6	71 8	70·6	70·0	69·5	69·1
Wet Thermometer......	Dec. 1856.	71·1	70·9	70·9	70 9	70·7	70·7	70·6	70·7	70·6	70·4	70·3	70 3
	Jan. 1857.	70·4	69·9	69 5	69·3	69 2	69 1	68·9	68·7	68.6	68 5	68·5	68·3
	Feb. do.	72 3	72·0	71·7	71·2	70 6	70·2	69 7	69 0	68·4	68 1	67·7	67·4

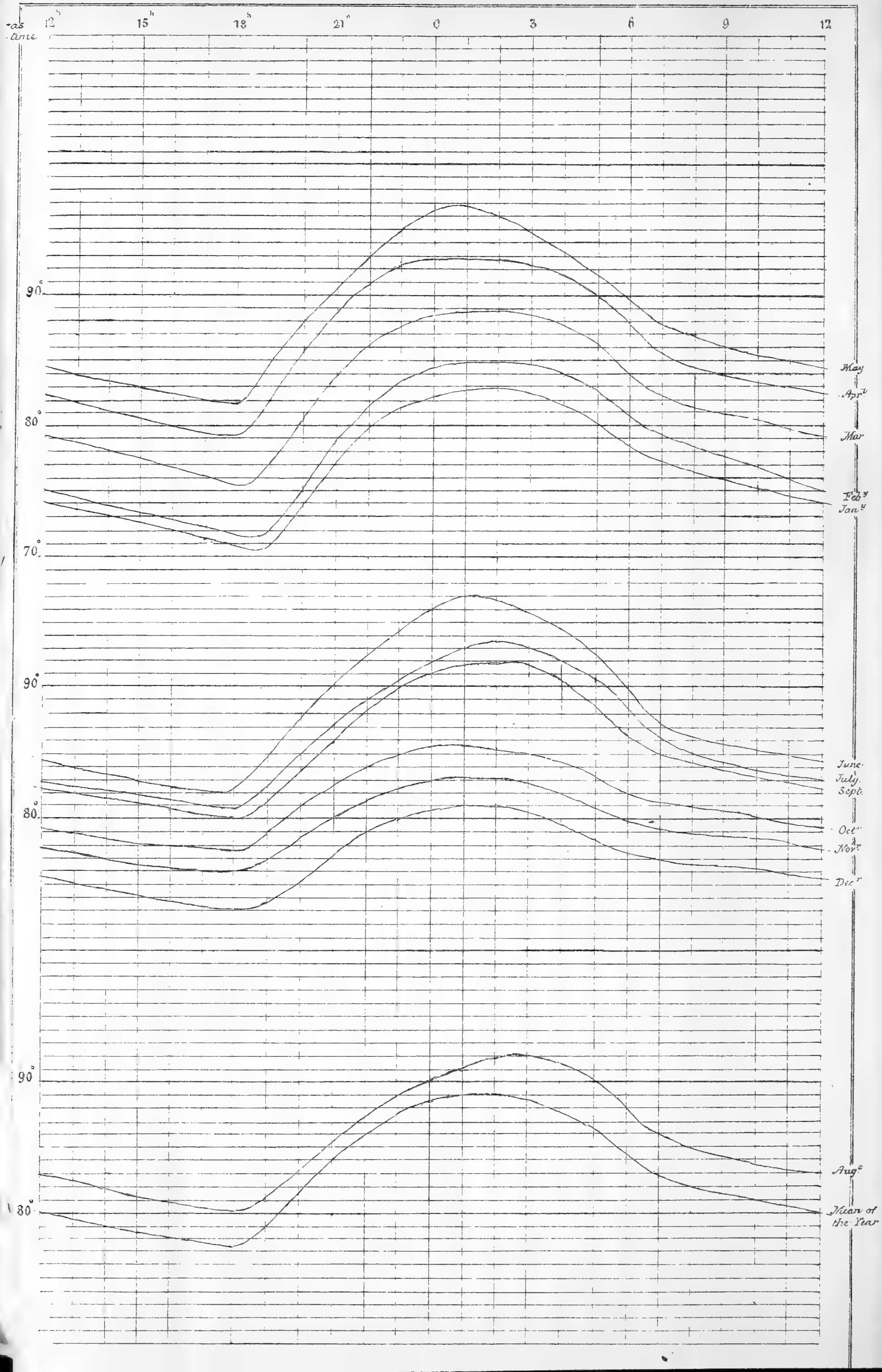
Gottingen Mean Time....		12	13	14	15	16	17	18	19	20	21	22	23	
Madras Mean Time......		h. m. 16 41	h. m. 17 41	h. m. 18 41	h. m. 19 41	h. m. 20 41	h. m. 21 41	h. m. 22 41	h. m. 23 41	h. m. 0 41	h. m. 1 41	h. m. 2 41	h. m. 3 41	Means
		In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	Inches
Barometer at 30° Faht...	Dec. 1856	29·944	29 958	29 978	30·006	30·025	30·026	30·015	29·987	29·957	29·932	29·918	29 918	29·972
	Jan. 1857.	·988	30·002	30·017	·042	·070	.075	·065	30 043	30·012	·981	·961	·955	30·010
	Feb. do	·904	29·919	29 939	29·965	29 987	29·999	29·990	29 969	29·940	·908	·883	·871	29 934
		°	°	°	°	°	°	°	°	°	°	°	°	°
Dry Thermometer......	Dec. 1856.	72·7	72·4	72·1	73·8	76·2	77·7	78·7	79·1	79.2	79 1	78 9	78.2	75 6
	Jan. 1857.	70·7	70·2	70·1	72 4	75·5	77·8	79·0	79·8	80.1	80·1	79·7	79·1	75·3
	Feb. do.	68·6	68 2	68·3	71·6	75·6	79·0	81·0	82·1	82 8	83 0	82·6	81·9	75·4
Wet Thermometer......	Dec. 1856.	70·2	70 0	69·8	70·4	71·2	71·5	72·0	72·1	71·9	71 7	71·9	71·6	70 9
	Jan. 1857.	68·0	67·8	67·7	69·0	70 2	70 7	71·0	71·2	71·3	71 3	71·1	70·9	69·6
	Feb. do.	67·1	66·8	67 0	69·3	71·3	72·3	72·3	72·0	72·5	72·8	72·7	72·4	70 3

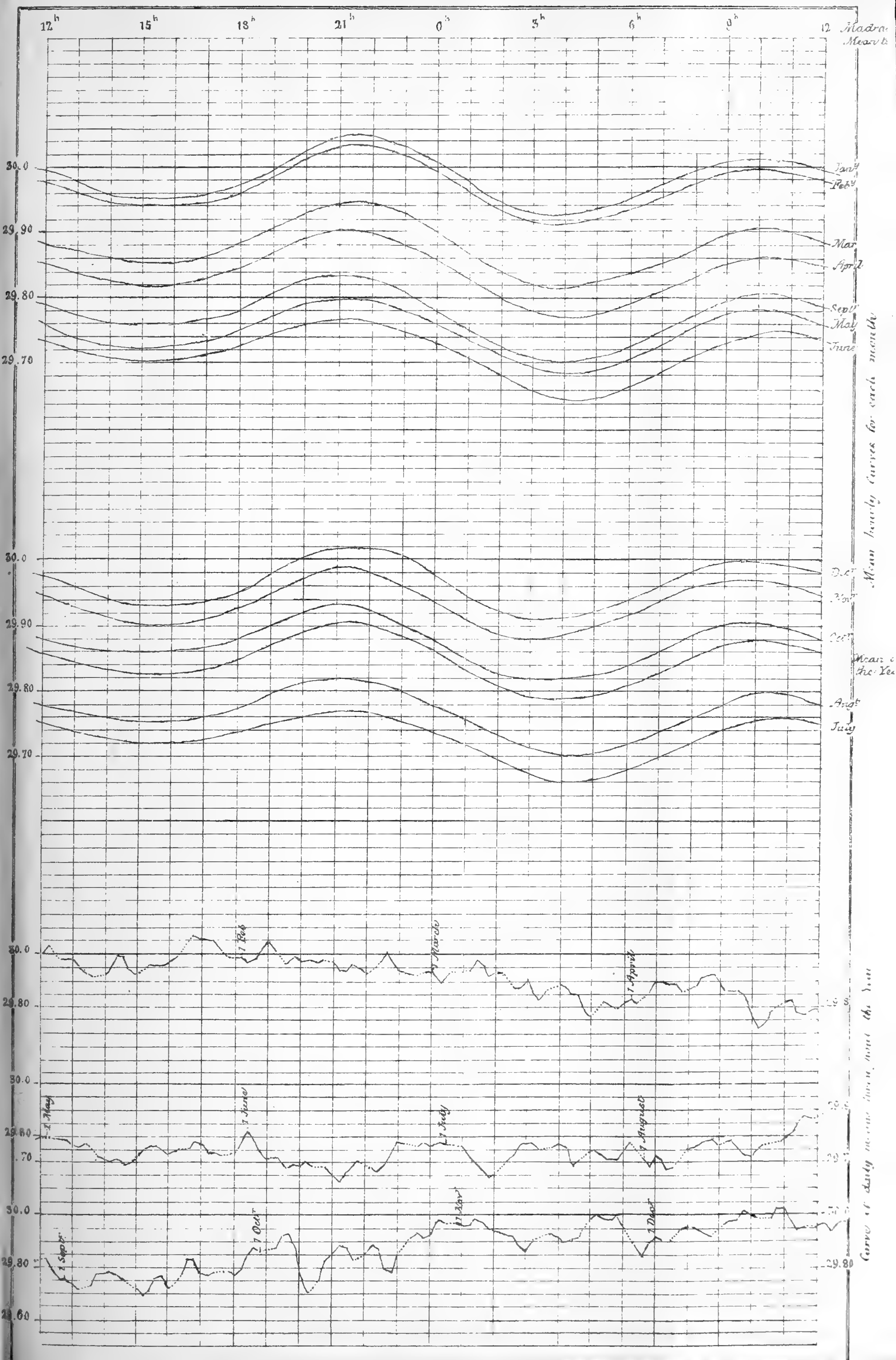
* The Numbers in these Columns are not observed but interpolated for the sake of obtaining the daily means.

MADRAS,
9th March, 1857.

W. S. JACOB,
Hon'ble Company's Astronomer.

STANDARD THERMOMETER.





12h 15h 18h 21h 0h 3h 6h 9h 12
30.0
29.90
29.80
29.70
Jany
Feby
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Mean hourly Curves for each month
Decr
Novr
Octr
Mean of the Year
Augt
July
1 Feb
1 March
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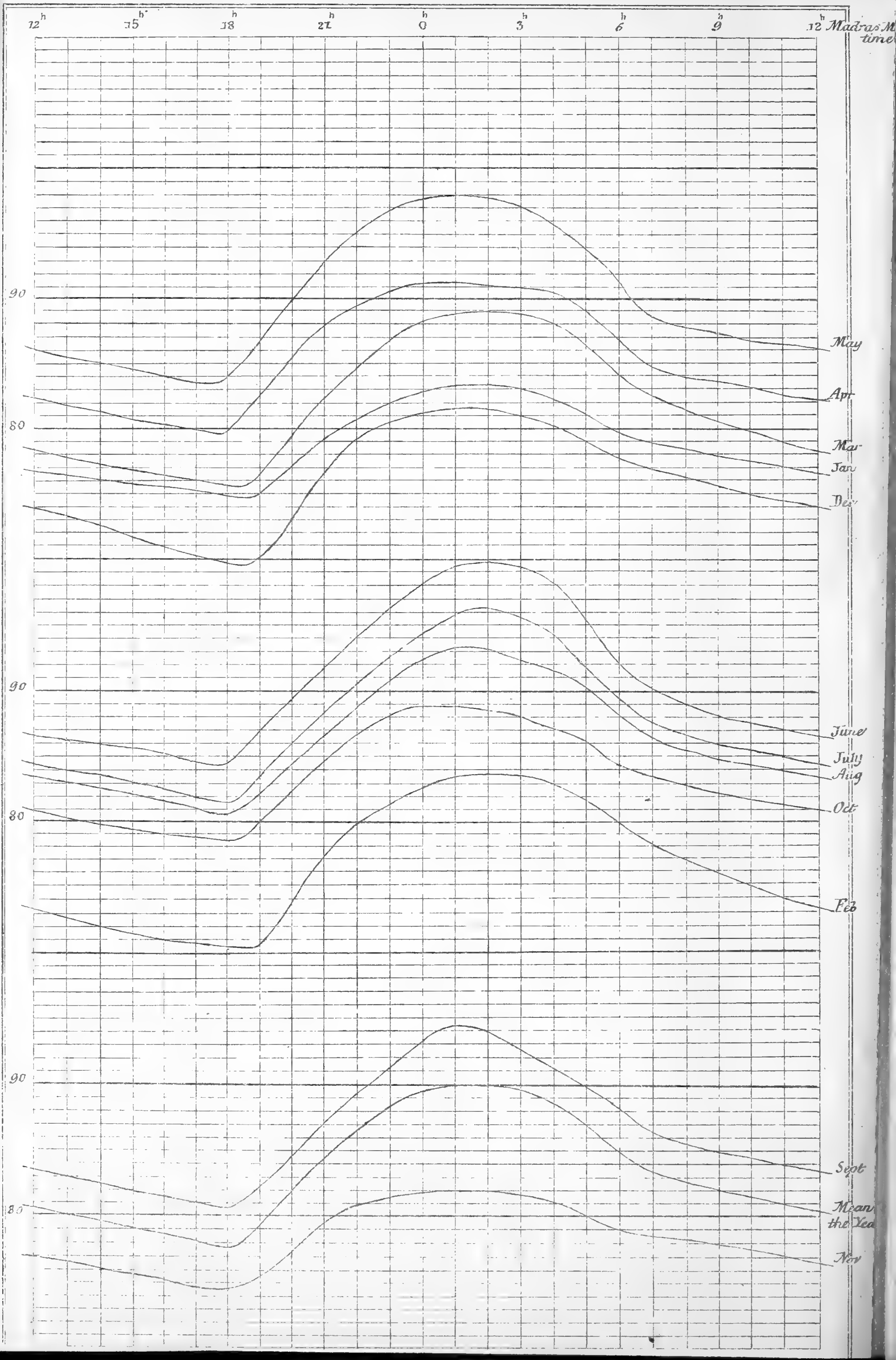
1 May
1 June
1 July
1 August
1 Sept
1 Octr
1 Nov
1 Decr
29.60
29.80


12h
15h
18h
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3h
6h
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Madras M. time
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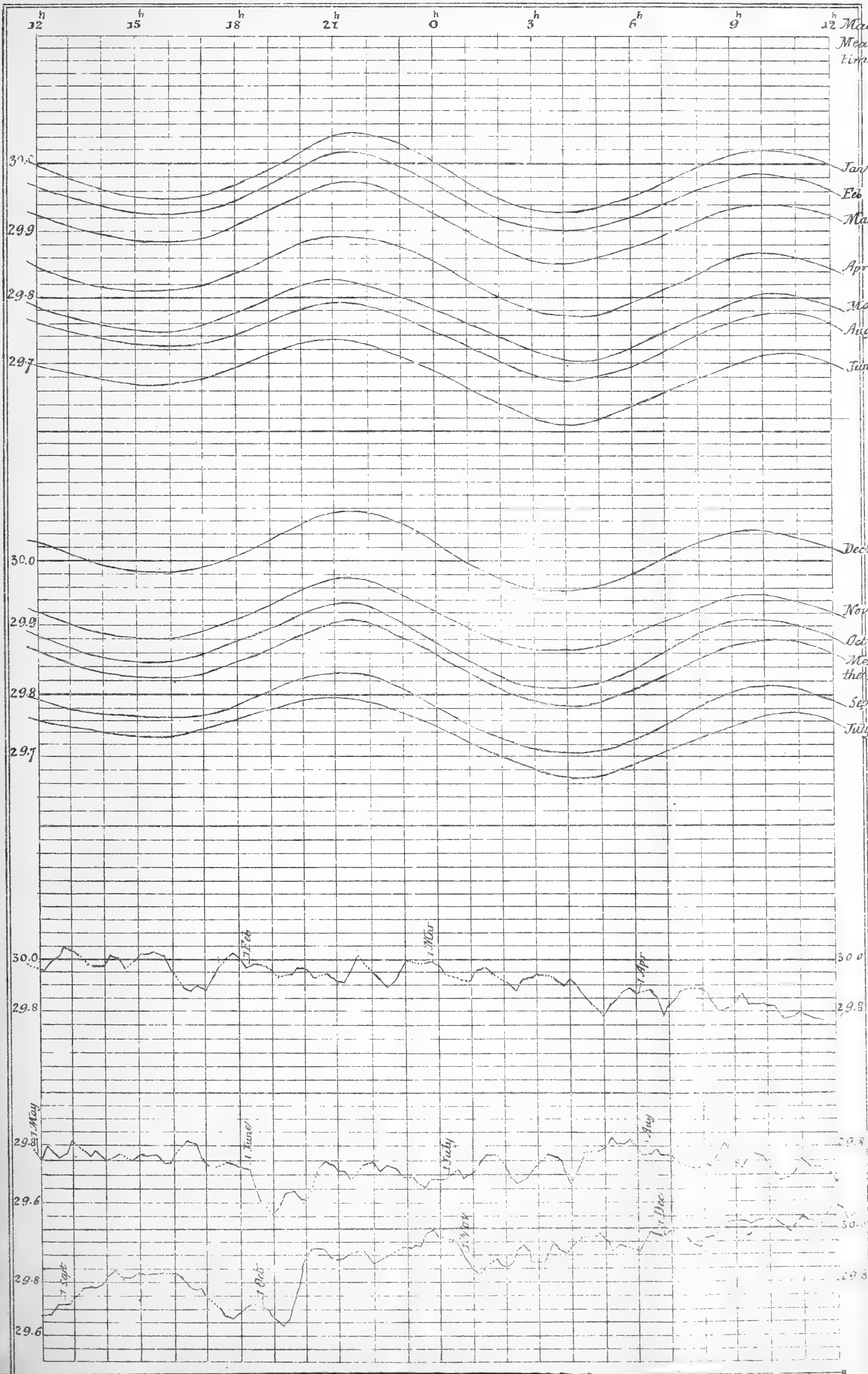
Sept
Mean the Year
Nov


12h 15h 18h 21h 0h 3h 6h 9h 12h Mad Mean time
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Jan
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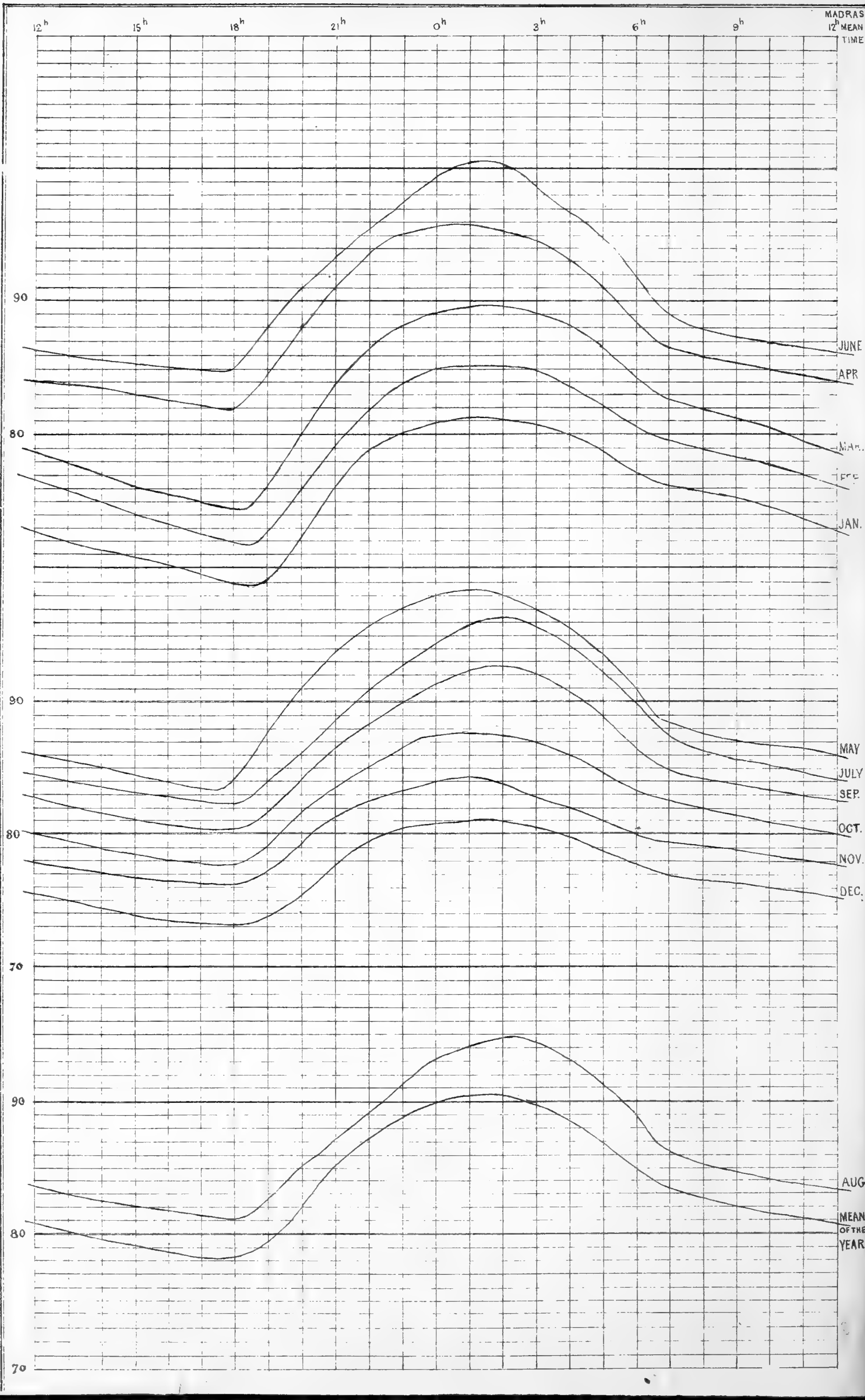
MADRAS JOUR. LIT. & SCIENCE PLATE 5. No. 2. N. S.

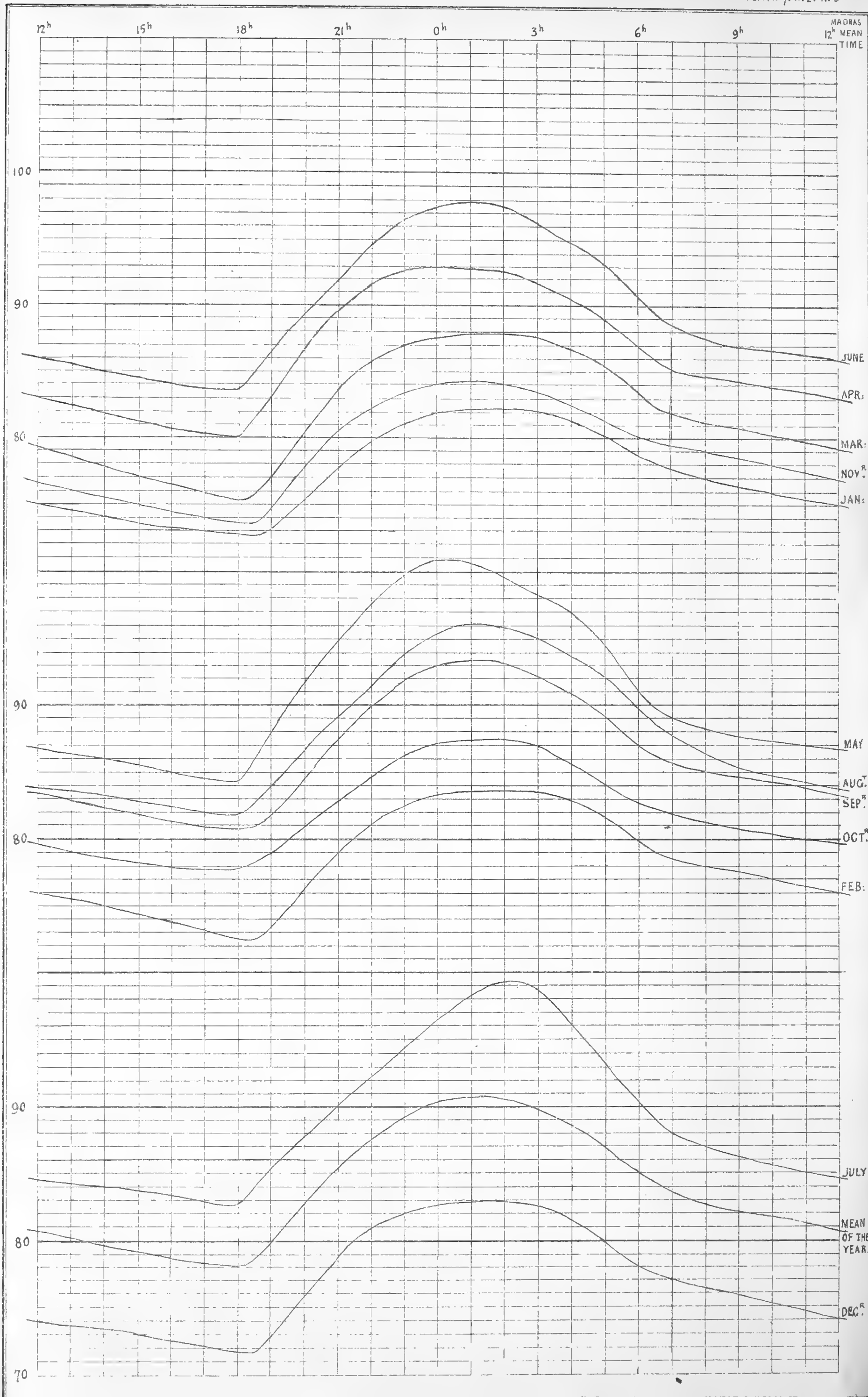


THE CURVES FOR APRIL, MAY, & JUNE ARE RAISED 0·10 ABOVE THEIR PROPER PLACES.

THERMOMETER.

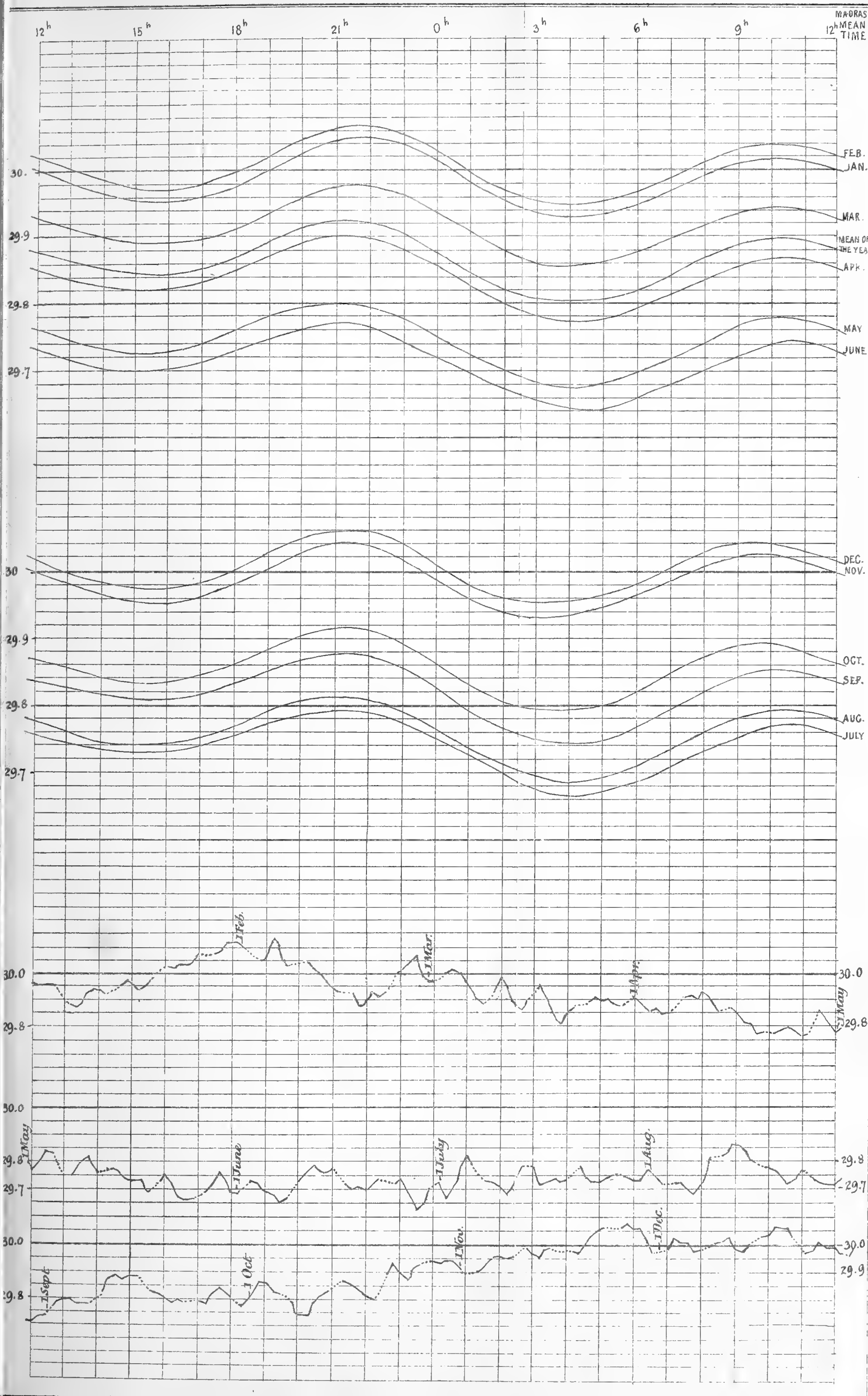
MADRAS JOUR. LIT. & SCIENCE

PLATE 7. No. 2. N. S

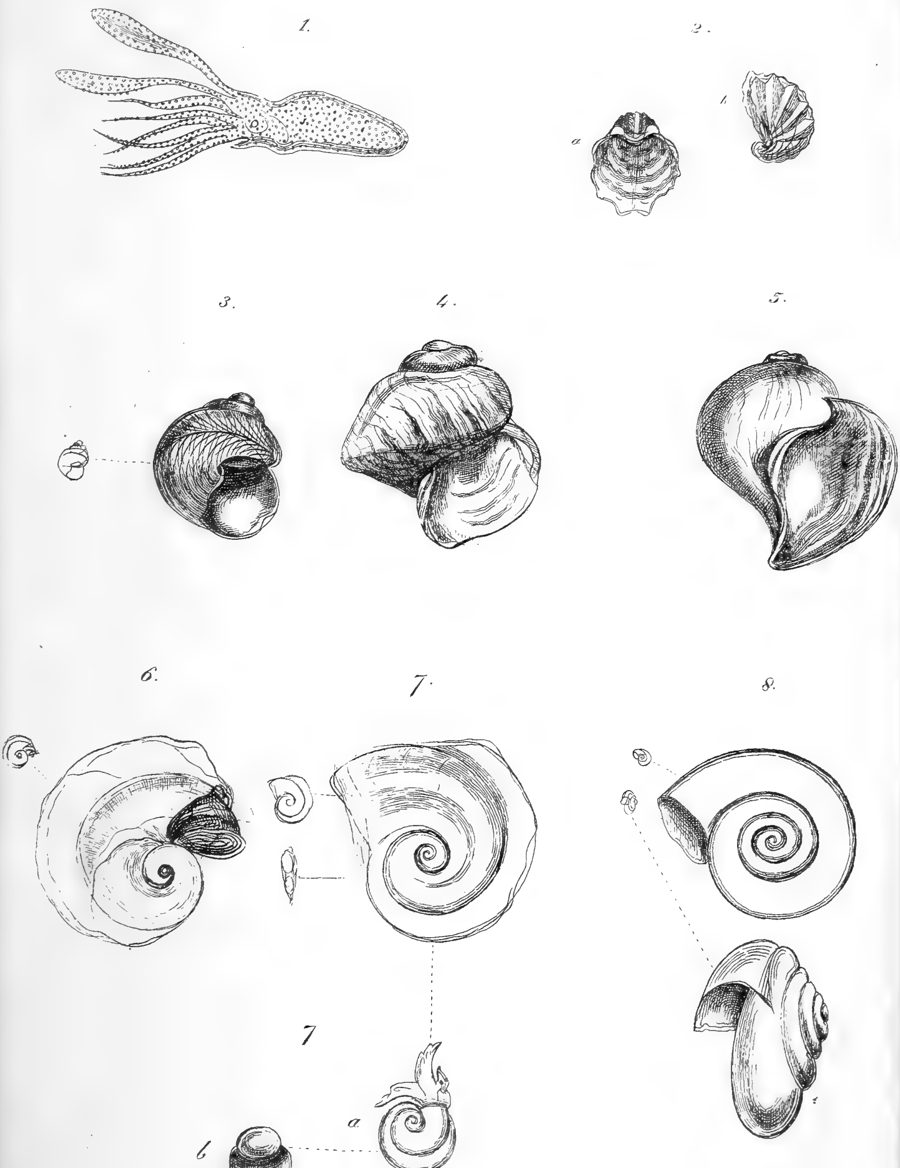


1855.

BAROMETER.



Curve of daily means throughout the year.


1.
2.
a
b
3.
4.
5.
6.
7.
8.
7
a
b

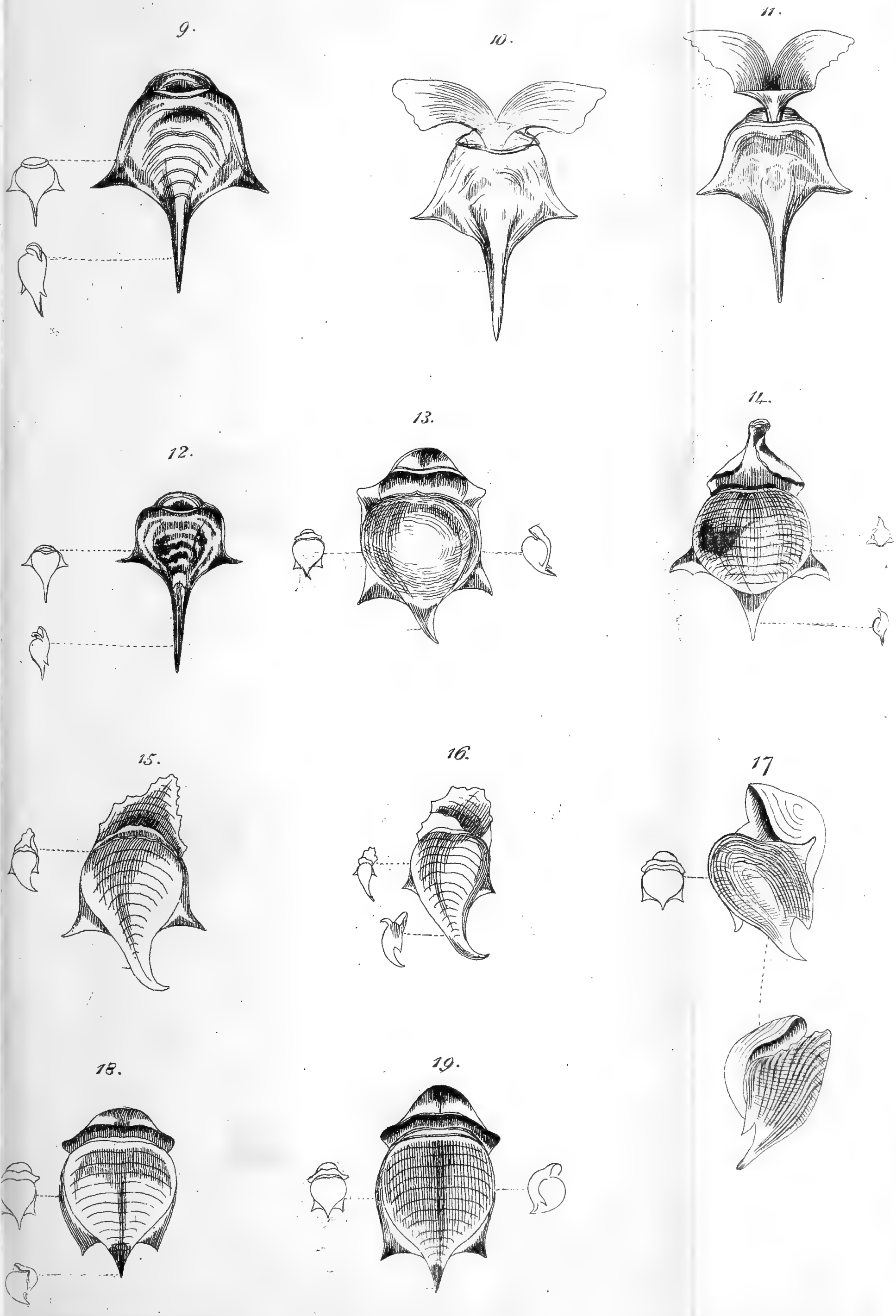


Plate X. No 2 N.S.

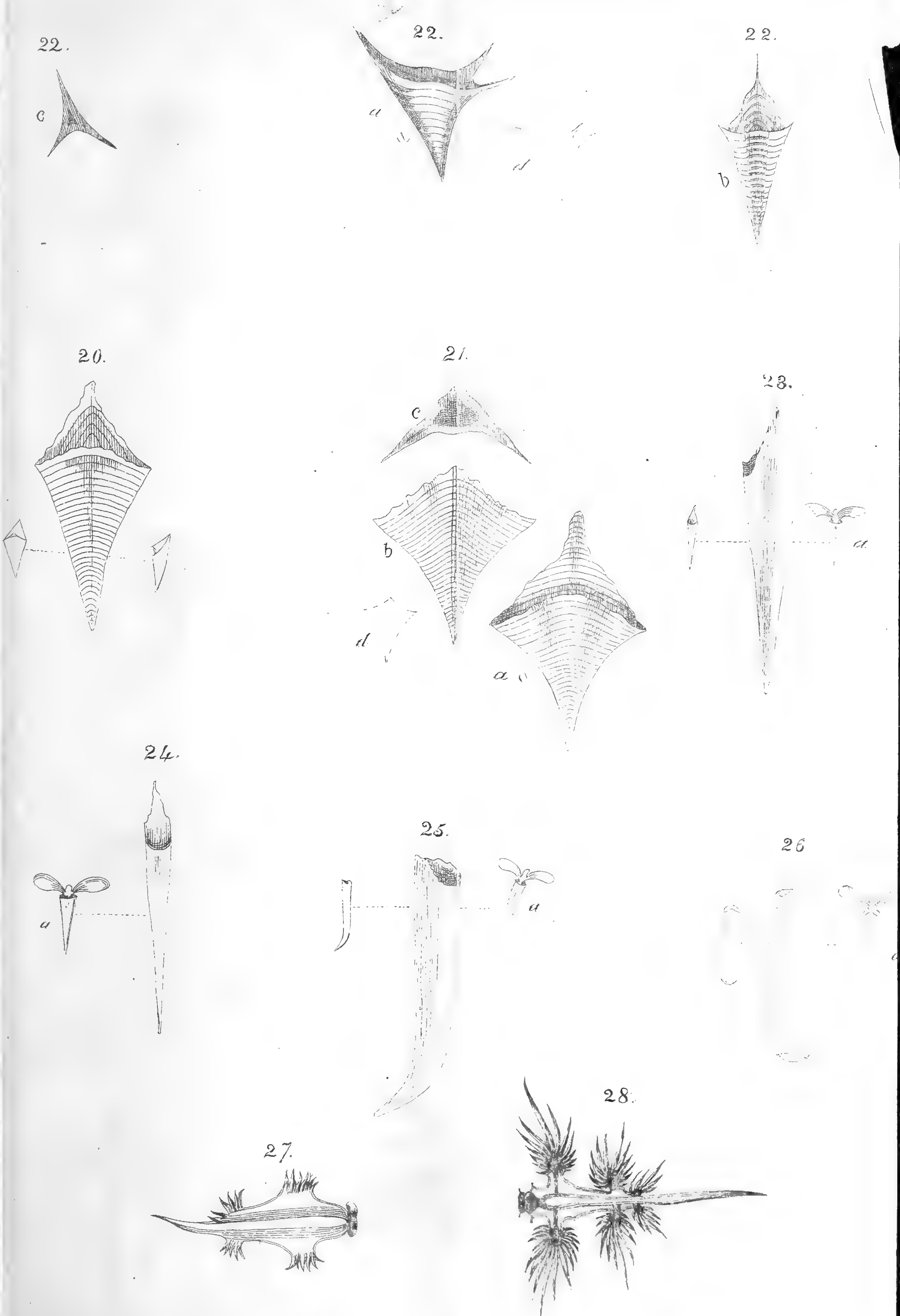
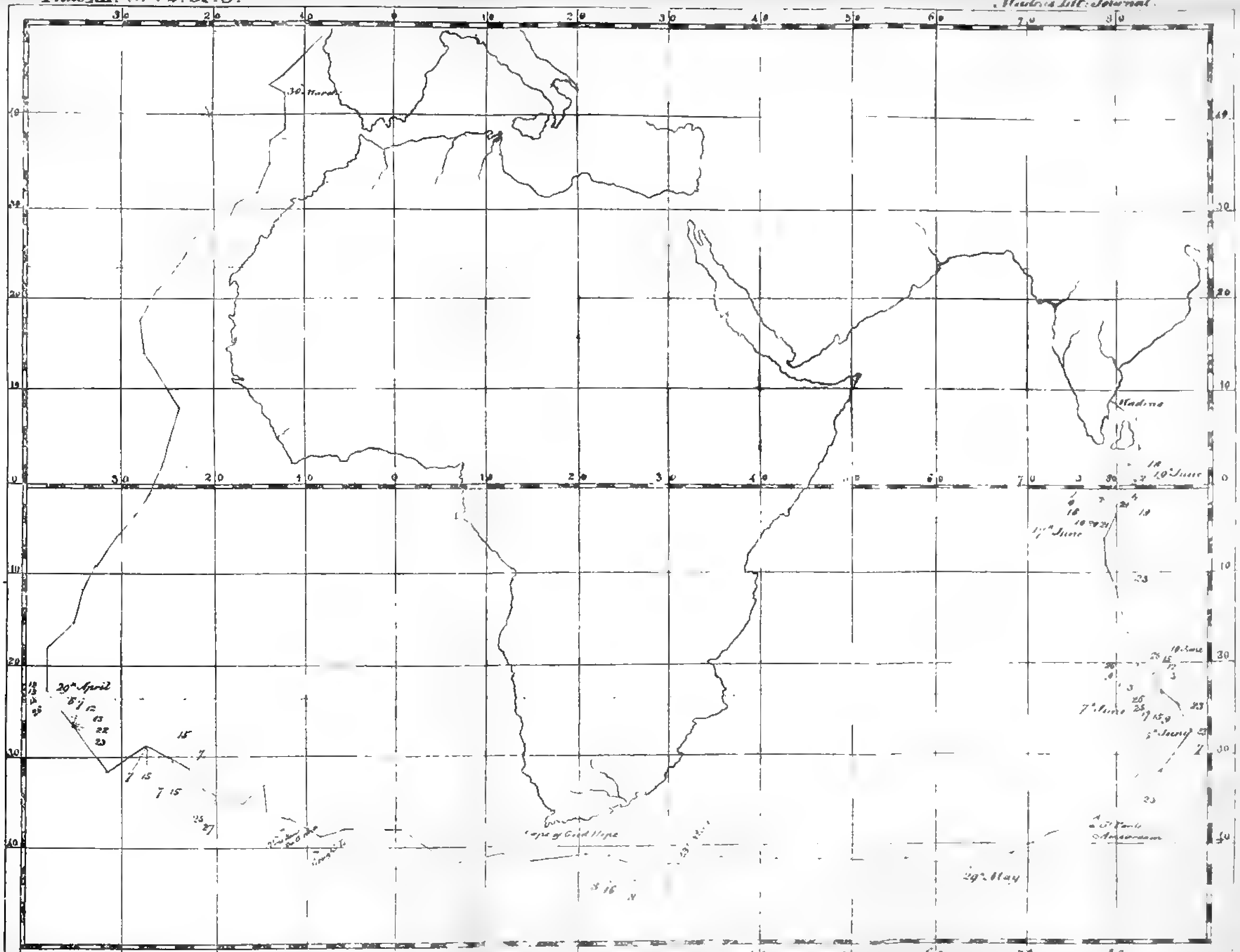


Plate XI, N° 2, N.S.

Madras Lit. Journal.



John Duarte Lith

ADVERTISEMENT.

GEOLOGICAL MUSEUM,

IN CONNECTION WITH THE

GEOLOGICAL SURVEY OF INDIA,

HASTINGS' STREET, CALCUTTA.

THE Government of India having recently sanctioned a considerable extension of the "Museum of Economic Geology for India," which had for some years existed under the careful superintendence of Mr. Piddington in connexion with the Asiatic Society of Bengal, the attention of all who may be interested in the study of Geology, and of all who may desire the internal improvement of this country, is solicited to the objects of this Institution; and their aid in the promotion of these objects is requested.

In the year 1840, a Museum of Economic Geology for India was established, under the sanction of the Honorable the Court of Directors. Its objects and aim were clearly set forth in a brief statement drawn up by Mr. Piddington, and freely circulated at the time. In conjunction with the Asiatic Society of Bengal, and in their Rooms, it grew into some importance, and gradually became the depository of many good and valuable specimens, illustrative of the mineral wealth of this country. But simultaneously with its growth, the Science of Geology itself was rapidly attaining its present developement. All cognate Sciences were spreading their domain, and the results of investigations in each were becoming more widely and more largely known. Since then, also, the study of Mineralogy, of Geology, and of Chemistry, has been introduced as a part of the established course of Education and the practical applications of these Sciences to Mining and to Engineering generally will soon be as regularly taught in this country as they have been for years past in Europe.

The extension of the Museum had become, therefore, essential if it were to keep pace with the progress of knowledge, and to retain any of its value as a means and aid to instruction. With this view, the Right Hon'ble the Governor General in Council has given orders for the formation, on a much more extended scale than hitherto, of a general Geological Collection, with a special view to illustrate the geological structure, the mineral wealth, and the manufacturing resources of this Empire. A commodious house has been rented for the purpose at present, and it is intended that abundant accommodation shall be provided for the Museum in the new building for the University in Calcutta, when the Geological Collection

will form a portion of the general collections of Natural History to be connected with that establishment.

In the Museum now in progress of formation, every thing tending to illustrate the Geology of this Country, in its widest sense, will find a place. The history of the Science, the progress of its investigations, the nature of its classifications, the phenomena with which it is concerned, the laws of those phenomena, will all be illustrated. The grand series of organisms, the remains of which occur in such abundance in various deposits, will be exhibited, and the whole Natural History of rocks traced out so far as collections enable this to be done. By the aid of Drawings, such objects as cannot be procured will be made familiar to the Student, and by the use of Maps, the structure of countries, which it would be impossible for many to visit, will be made known.

While thus endeavouring to render the Student acquainted with the principles of the Science, the practical applications of these principles will, at the same time, be fully exhibited. Mining processes, mining products, and the principal metallurgical operations, will also be included, and the comparative excellence of each, so far as possible, made known. The building materials of the Country, and their applications, the localities where used, the durability, the facility of working, the strength, &c., of the stones, will all be examined into. The importance of Mineral Waters must not be overlooked, and the value of these will be determined by careful investigations.

Further, in a country so essentially agricultural as India, the character of the soils and sub-soils, their peculiar adaptation to peculiar crops, their composition, and, in dependence upon this, the easiest means of renewing or increasing their fertility; all these are important questions which at once connect themselves with the researches of the Geologist, inasmuch as the natural powers of any soil depend essentially on the source from which that soil has been derived, and therefore on the geological structure of the district.

To enable such enquiries to be effectively carried out, a small Laboratory is attached to the Museum, where such analyses and investigations as may be requisite will be carried on; and it is hoped that most valuable, because accurate and detailed, information may thus be acquired.

Moreover, careful summaries of all existing knowledge on the geological structure of the Country will be compiled and arranged, so as to facilitate reference. Much has been done in investigating the geological structure of this Country, and very valuable papers have been given to the public, descriptive of various parts of India. But these facts are scattered through various periodicals, are often only incidently noticed in travels, or can be found only in manuscript among the Records of Public Offices. Many of these are with difficulty intelligible, from the writers frequently calling similar objects by different names, or *vice versa*. It is therefore, necessary to obtain the key to the terms used before these can be compared. It will be an object with the Officers of the Geological Survey to remove this difficulty, and to bring into an accessible form every thing which has been published bearing on the geological structure, the mineral wealth, or the manufacturing industry (so far as this is concerned with mineral products) of this Empire.

The Museum of Geology has been placed in connexion with, and under the same superintendence as the Geological Survey of India. By this means opportunities will be afforded of procuring a very perfect series of the rocks, fossils, and minerals of the Districts visited by that Survey. But the aid of all is solicited in completing such local collections as may illustrate the structure of the several districts. Every one will be able to contribute something of value. Those permanently resident in any locality have infinitely greater advantages and facilities for procuring good illustrations of its mineral structure and products than any visitor could enjoy, and from such we confidently look for much that will prove of great interest and of great value. Every thing which can, in any way, tend to illustrate the rocks, the fossils, the minerals, or the practical applications of these will prove interesting.

Regarding the nature and properties of all specimens forwarded, the fullest information will be freely afforded, on application to the Curator of the Museum. Organic remains will be examined, and, so far as possible, carefully named for contributors, and every facility given for the investigation of any particular subject or any particular line of research connected with Geology.

The formation of a Library of reference, in connection with the Museum, has been sanctioned, and has already made considerable progress, Under proper restrictions, this will be accessible to all Students of Geology, and others interested in such enquiries.

Catalogues of the several departments of the Museum will be issued from time to time. Public Officers, and other persons in all parts of India, are requested to send contributions. All specimens, carefully packed, may be forwarded by the safest and most economical mode of conveyance, addressed to

THE MUSEUM OF GEOLOGY,
No. 1, HASTINGS' STREET,
Calcutta.

And it is requested that a communication stating fully the wishes of the donors may, at the same time, be forwarded by post to

THE DIRECTOR OF THE MUSEUM OF GEOLOGY,
No. 1, HASTINGS' STREET,
Calcutta.

Rules for Admission of Public, &c.

The Museum will be open Daily, excepting Sundays, from 10 o'clock A. M. *to* 6 P.M.

ADMISSION FREE.

VISITORS are requested to enter their names, and number of party, in a Book provided for that purpose.

The attendants in the Museum are strictly forbidden to speak to, or interfere

with visitors in any way, excepting for the protection of the Museum and its contents.

It is particularly requested, that any irregularity or want of civility may be reported at once to the Curator of the Museum.

The collections being exposed for public benefit, it is confidently hoped that the public will feel the importance of carefully preserving what conduces to their instruction and advantage, and will therefore aid the Officers of the Museum in the discharge of their duty.

Students of Geology, or persons desirous of information on any special point, are requested to apply to the Curator at the Museum on Tuesdays and Saturdays, between the hours of twelve and four. In particular cases, this aid will be afforded at any time; but as it is essential that the Officers in charge of the Museum should be able to devote much of their attention to the arrangement of the collections, to the examination of specimens, and to the general duties of their Office, it is hoped that the public will aid in these objects by not interrupting them, under ordinary circumstances, at other times than those fixed above.

Gentlemen interested in geological pursuits, mines, &c., in special agricultural objects, or in the use of new or untried building materials, &c., who may desire detailed examination of any mineral substance, or definite information for a special object, are requested to apply by letter (post paid) addressed to the *Director of the Museum of Geology*, 1, *Hastings' Street*, *Calcutta*, stating as clearly as possible their wishes. All such communications will be attended to at the earliest possible opportunity, and in the order of their receipt.

Visitors and others are requested to contribute to the collections every thing which may appear interesting, or locally peculiar.

The servants of the Museum are prohibited, under pain of instant dismissal, from asking for, or receiving, any gratuity whatever, and it is hoped that none may be offered.

The Museum will be open from the 1st day of January 1857.